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# USSR Report

ECONOMIC AFFAIRS

No. 1041

EKO: ECONOMICS AND ORGANIZATION  
OF INDUSTRIAL PRODUCTION

No. 10, October 1982

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24 February 1983

USSR REPORT  
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## EKO: ECONOMICS AND ORGANIZATION OF INDUSTRIAL PRODUCTION

No. 10, October 1982

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## ANNIVERSARY ARTICLE REVIEWS EKO'S EDITORIAL POLICY

Novosibirsk EKONOMIKA I ORGANIZATSIYA PROMYSHLENNOGO PROIZVODSTVA in Russian  
No 10, Oct 82 (signed to press 26 August 1982) pp 3-18

Article: "What We Write About and Why"

Text

I want  
the pen to be equal to the bayonet  
With cast iron  
and a steel finish

V. Mayakovsky

This issue of the magazine is the hundredth since the day it was established in 1970. These 100 little books with an average of 10 printer's sheets each is EKO's contribution to publicizing the party economic policy.

### What Determined the Subject Matter

The period of our magazine's life has been a time of large economic decisions adopted by the 24th, 25th and 26th CPSU Congresses and a time of study and implementation of the documents they drew up. The Party Congresses and the Central Committee Plenums that have taken place between them have obeyed Lenin's demand: to transform them "into agencies for checking on economic successes, into agencies where we can really study economic construction."\*

And there has been something to learn.

Having noted the growing scale of the national economy and the successes in distributing the labor force and insolving a number of important social problems, the party forums at the same time pointed out serious shortcomings in the administration of the Soviet economy.

"The increased scale and the qualitative strides in our economy do not allow us to be satisfied with the existing forms and methods, even if they have

\*Lenin, V. I. "Poln. sobr. soch." Collected Works, Vol 42, p 157.

served well in the past" (From the accountability report to the 24th Party Congress, 1971).

"The revolution in science and technology requires cardinal changes in the style and methods of economic activity and a resolute struggle against inertia and routine behavior" (From the accountability report to the 25th CPSU Congress, 1976).

"One cannot adapt the living, developing organism of administration of the economy to fixed, customary forms. On the contrary, the forms must be made to correspond to the changing economic tasks" (From the accountability report to the 26th Party Congress. 1981).

All these requirements that were cited were proclaimed by Comrade L. I. Brezhnev. They reflect the permanent party course toward economic search, whose goal is to create a more efficient system of economic relations for the sake of fuller satisfaction of the needs of the society and for the sake of the well-being of the Soviet people.

In the documents of the last three Party Congresses and the Central Committee Plenums that were held in between them one can survey the profound continuity, the desire to develop and resolve a unified complex of problems of developed socialism. It is precisely a complex, and herein lies the peculiarity of the historical period in which we live. Real socialism demonstrates the great complexity of its structure, the variety of economic ties and dependencies and the dialectical contradictoriness of the developmental processes taking place in it. These processes affect each one of us and therefore their theoretical analysis long ago ceased to be the domain of a narrow group of theoretical scholars, and brought into its orbit economic managers, workers of party agencies, rank-and-file planners, sociologists and many thousands of Soviet people who are interested in interpreting the daily practice of management with its undoubted successes and, at the same time, complexities, blunders and mistakes. Economic theory has never before depended to such a degree on the lessons of daily practice nor has it needed so much the generalization of actual experience for its conclusions and recommendations. On the other hand, practice too, perhaps, has never awaited with such impatience the precise recommendations of fundamental sciences which put into the hands of the practical workers the instrument for foreseeing the consequences of any decision that is made. "Not a single society," said Comrade Brezhnev, "has had such a need for scientific theory as the socialist society. Therefore theory should continue in the future to lay the way for practice and provide a strictly scientific approach to the management of the economic and cultural life of the Soviet people."

Hence also the role of the scientific press, a particle of which is our magazine. Academic science relies on its pages to disseminate advanced experience, and, on the other, to clarify the essence of the socio-economic processes taking place in the society and to make it more convincing and legitimate by presenting various viewpoints and helping to develop in Soviet people a high economic culture, a truly scientific world view and conscientious behavior in the ocean of economic problems. This is precisely how the EKO editorial staff understands its major task.

In carrying out this task the magazine has offered its pages to scientists, production managers, rank-and-file businessmen and publicists. Looking over the 100 EKO booklets that lie before us, we see especially clearly the interest and energy displayed by the readers when considering the problems of our economy that appear on the pages of the magazine.

### Experience and Again Experience!

Striving to satisfy the readers' demands more fully, we have constantly asked them what in the journal was useful for them, what they liked, and what was superfluous. If one returns to the evaluations we received one can easily trace the structure of the interests and demands of that audience which reads and subscribes to EKO.

Considerable interest has been aroused by material about advanced experience. The comprehensive experience in organizing production and wages at the AvtoVAZ, the experience in organizing autonomous financing relations at KamAZ, the innovative experience at the Minsk tractor plant, the Sverdlovsk Uralelektryazhmas and the Leningrad Elektrosila, the concern for working and living conditions at the Tiraspol sewing factory and in far northern Nórilsk, collective forms of organization and payment for labor among machine operators of Altay and the system of struggling for high production discipline at Magnitka, the orientation of production toward the consumer among Moscow machine tool builders, Rostov footwear workers and Siberian automated machine adjusters, discussions of how processing centers from Ivanovo and refrigerators from Krasnoyarsk made their way to the international markets--all these and many other materials about advanced experience were well received by the readers and rendered real assistance to managers of hundreds of enterprises. They wrote to the magazine about this. They rated highly the articles about the experience in the organization and payment for brigade labor, the utilization of the indicator of normative net output, the application of functional value analysis, the organization of business learning games, the use of algorithms for occupational training, the experience in consultative activity, information systems for managers and many other things. We are glad that this published material was really useful and that advanced methods of administration are more and more influential among managers of the higher and secondary levels. We intend to continue to attach decisive significance to materials about advanced experience.

### The Main Figure--The Author

EKO is a magazine of the Acadamy of Sciences and even by virtue of this position it is a kind of bridge between the science of administration and daily practice. Remembering this, and also satisfying the wishes of the readers who have written that they want to obtain information "firsthand" from eminent scholars, the magazine has devoted a good deal of attention to selecting authors, inviting the most competent specialists to consider economic problems. The editorial staff experiences a feeling of pride when giving the names of these authors. Writing on the pages of EKO have been the academicians A. P. Aleksandrov, D. K. Belyayev, S. T. Belyayev, O. T. Bogomolov, G. K. Boreskov, V. M. Glushkov, Ye. P. Velikhov, A. N. Yefimov, T. I. Zaslavskaya,

L. V. Kantorovich, V. A. Koptyug, A. P. Krylov, M. A. Lavrent'yev, G. I. Marchuk, L. A. Melent'yev, N. P. Mel'nikov, N. N. Nekrasov, Yu. Ye. Nesterikhin, I. F. Obraztsov, B. Ye. Paton, A. M. Rumyantsev, A. N. Skrinskiy, S. L. Sobolev, S. G. Strumilin, A. A. Trofimuk, N. P. Fedorenko, T. S. Khachaturov, A. I. Tselikov. They have written broadly and insightfully about the experience and the obstacles on the path to ties between science and production, about the poor utilization of the achievements of scientific and technical progress, reserves for planning and social control, optimization of economic processes, and problems of utilizing computer equipment, reserves of energy, geology, metallurgy, instrument building and electric welding, automation of production and scientific research processes, and restructuring of higher and secondary education. Some of these problems which were raised by eminent scholars have been considered on the pages of EKO repeatedly and have found their ways into debates and insightful discussions at the magazine's "round table." The readers' responses have confirmed that we have acted correctly.

But we have not turned just to science in our search for new solutions. In the hands of the best economic managers, methods that have been tested by domestic and foreign science acquire new features and actually enrich the arsenal of administration. It is with a feeling of deep gratitude that we say that the directors of the largest enterprises, the flagmen of soviet industry, in spite of how busy they are, have never refused to give attention to our magazine. Their articles have enriched it a great deal. We intend to continue in the future to take advantage of their invaluable experience: successful solutions for the modern day, recollections of economic lessons of the past, and thoughts about tendencies leading to the future.

#### The Zone of the Highest Exertion of Effort

EKO is a unionwide magazine and we consider general economic problems using the examples of many regions. But there is a region to which we turn especially frequently, and not by accident.

#### This is Siberia.

The development of the productive forces of Siberia is certainly not just the Siberians' affair. Economic and mathematical calculations have clearly shown that if Siberia does not develop at rates that exceed the average indicators for the country 1.2-1.4-fold, the development of the USSR economy will slow down. Hence EKO's constant interest in problems of assimilating new eastern and northern territories, the Western Siberian petroleum and gas complex (and soon in Eastern Siberia too) and the assimilation of the BAM zone, KATEK, and the soviet Arctic zone. All these are not simply areas for pioneering assimilation and the highest exertion of effort. Figuratively speaking, these constitute the zone of the year 2000, the zone of the third millennium. The Siberian Branch of the Academy of Sciences, which was awarded the Order of Lenin this year, is developing the strategy for the assimilation of this zone. To be the economics journal of the Siberian Branch of the Academy of Sciences means to help in the introduction into practice of the large scientific stockpile of Siberian scientists. Here EKO is aware of a certain indebtedness and intends gradually to repay it.

### They Strove to Give A Constructive Analysis

A very responsible task for the magazine was the series of articles and discussions that respond to the persistent requests of the readers to help them figure out the tendencies in the development of soviet economics.

Behind the polemical acuity of these letters lies the active position of their authors which is very important to us. They turn to the scientific press (of course, not only to our magazine) with confidence that they will receive detailed and frank answers to the questions they raise.

And we have tried to give these answers as much as possible. Today we intend to use a couple of lines of this article to make reference to the main materials that has contained constructive analysis and concrete recommendations. Not a single one of these articles can claim to give an exhaustive interpretation of the problems raised by life, but still they provide the readers with a sufficiently serious analysis of the problems that are bothering them. Let us name several of the articles: "The Economic Mechanism: Crucial Questions of Improvement" (1979, No 1); "Centralized Management Plus the Initiative of the Enterprises" (1979, No 7); "Intensification of Public Production in the CEMA Countries" (1979, No 6); "Centralization and Independence" (1980, No 2); "Organizational and Structural Factors in Economic Growth" (1980, Nos 5, 6); "Economic Behavior and Economic Development" (1980, No 3); "Intensification of Production and the Technical Policy in the 1980's" (1981, No 5); "The Economic Mechanism and the Style of Thinking" (1981, No 2); "Branch Production and Departmental Separation" (1981, No 11); "Financial-Credit Levers and Intensification of Production" (1981, No 7); "National Well-Being and Improvement of Distribution Relations" (1982, No 1); "Investments--The Engine of the Economy" (1982, No 3); and others.

Listed here is a small part of the articles of our authors, each trying in his own way but with positive positions in common, to consider a particular group of problems related to the efficiency of management and the task of gradually changing the soviet economy over to the path of intensification. This is one of the magazine's most important subjects and will continue to be in the future.

### Irreplaceable Feedback

One must say that many interesting subjects which were subsequently approved by the readers were also suggested by them. Problems of small enterprises, the work of the master in the shop, the technique of the personal work of the manager, the psychology of administration, improvement of the patent system, socialist enterprising, the position of the plant sociologist, foreign mini-plants, legal practice--all these subjects owe their origin to the readers.

Publicizing in the articles the priority of consumers of industrial products and the precise orientation of production toward their demands, the journal has tried to maintain the same approach to its own "consumers" the EKO readers. From several years' worth of correspondence and questionnaires, we have formed a mass of reviewers--more than 500 subscribers to the magazine from many cities of the country who have voluntarily taken on the fairly difficult task of

evaluating in points each article of each issue. They are like supernumerary workers of the editorial staff, our friends, whom today we thank once again for their assistance to the magazine. Without their demanding evaluations, remarks and advice it would be difficult for us to adjust the subject matter of the issues, to single out the most crucial problems and to draw up future plans. We consider it a great shortcoming of our work that we do not take enough advantage of this powerful potential of reader experts for questionnaires not only about the subject matter of the magazine, but also about the key problems of the economy: Group opinion is always the most valuable addition to the articles of specialists.

Quite spontaneously and somewhat unexpectedly for the editorial staff, clubs of friends of EKO have arisen in several cities. They have begun to function in Novokuznetsk, Chelyabinsk, Leningrad, Moscow, Tyumen, at the KamAZ, and in Leninakan. We have written briefly about some of them. Their work usually consists of discussions of questions raised on the pages of the magazine for clarification of the essence of the problem and the disclosure of possible points of view. From time to time the members of these clubs meet with the EKO editorial board, but the editorial staff itself, as a rule, does not participate either in the planning or in the work of these clubs, which are exclusively the product of local initiative.

Once every two or three years the magazine distributes questionnaires to all of its subscribers and readers. This was done in 1971, 1974, 1977 and 1979. During these years the number of subscribers has increased many times over, but the occupational structure has not changed significantly. Approximately 50 percent of the readers are workers in industry, including 10-12 percent chief managers and their deputies; approximately 35 percent are scientific workers, workers of design bureaus, instructors at VUZ's and students; approximately 12 percent are workers of ministries and departments and party workers; and 2-3 percent are second members of families. In 1983 we plan to update these data and make them more precise. Thus the editorial staff has a fairly clear idea of the audience for which our publication is intended.

#### Contributing to Raising the Consciousness of the Masses

The magazine has been in print since the adoption 8 years ago of the decree of the CPSU Central Committee, "On Further Improving Ideological and Political-Educational Work" (April, 1979). It helped our editorial staff as well as all of the soviet press to determine the main directions for their efforts, to define their responsibilities and to raise the levels of their materials. Additionally, we found in this important document a confirmation of the correctness of the path our magazine had taken. Demonstration of advanced experience, acceleration of scientific and technical progress, the introduction of the achievements of science and technology into the national economy, increased labor productivity and efficiency and quality in work--these are precisely the tasks toward which the decree of the CPSU Central Committee was directed. It was also emphasized that mass information agencies must raise questions extensively and boldly: "The tasks the party is setting for ideological and educational work preclude the fear that is still encountered of openly raising for consideration the crucial questions of our public life and the tendency

toward smoothing over or avoiding unsolved problems and crucial issues and remaining silent about shortcomings and difficulties that exist in real life. This approach and the inclination toward formal display do not help the matter, and only make it more difficult to resolve our common problems."

The famous words of Vladimir Il'ich concerning the degree to which the people are informed as a sign of a strong state rang out with new force in the Central Committee decree: "Under the conditions of developed socialism more than ever before one sees the extreme importance of Lenin's idea that the state is strong through the awareness of the masses, it is strong when the masses know everything, can judge everything and can address everthing consciously."

Hence our goal: to help those who take up our journal to judge intelligently the problems of the modern economy and administration and to proceed consciously on the path toward improving the economic mechanism, which requires no small amount of courage and breaking down many customary stereotypes in thinking and behavior.

#### Responsibility Grows Each Year

The reader is free to glean information from various sources. But in order to win his respect and confidence, it is necessary, in turn, to profoundly respect his demands and interests and to value his time and patience.

We are convinced that with any problem one can and should write not only intelligently and profoundly, but also interestingly. Economics, sociology and administration are interesting spheres of human activity and one cannot write about them with indifference. We are grateful to our authors for striving to make their writing in EKO accessible and clear without lowering the scientific level of the articles. We are grateful to our artists who, with a benevolent smile and notes of irony and humor, make the most serious materials more palatable. This style has repeatedly been approved by the readers and fully corresponds to the requirement formulated in the Central Committee decree concerning ideological work: "To reach a point where publications do not repeat one another . . . magazines must have their 'face,' their group of basic subjects and must present materials in the style and form inherent in their profile."

We have repeatedly asked our readers the question: "What should be changed in the content and form of EKO?" As a rule the answers that followed decisively warned the editorial staff against innovations that could destroy the existing image of the magazine to which the readers have become accustomed. Apparently, EKO is satisfying their demands in its main areas. Another confirmation of this is the dynamics of the circulation: from 8,500 copies in 1970 to 100,000 this year, in 1982. And the majority of the subscribers are not institutions, but individuals.

We should say that the circulation of 100,000 copies achieved this year not only gladdened us, but caused us to think about a lot of things. Actually the magazine is read in the majority of enterprises in the country. We have

repeatedly encountered cases where EKO materials on one subject over a number of years have been combined into unique collections, reproduced by plant or institute reproduction equipment and have served as training aides both in practical work and in teaching in various courses, institutes for increasing qualifications and VUZ's. Such confidence is greatly appreciated, but it obligates us to a great deal. Imprecision, assertions that have not been completely thought out, hasty conclusions and unjustified comparisons--all this can somehow be excused if the magazine is for specialists and has a small circulation, but it cannot be allowed in a mass publication. Understanding this, the editorial staff intends to be stricter and more demanding with the selection of materials intended for publication, and to edit them more attentively. At the same time increased responsibility certainly does not mean that we should play it too safe. We quoted the Central Committee decree concerning ideological work and we will steadily follow its requirement and not be afraid to raise crucial problems of the economy frankly and clearly. "Each article in a newspaper or magazine . . . should be regarded as a serious conversation with people who expect not only a correct and efficient presentation of the facts, but also profound analysis and serious generalization" (from the accountability report of the CPSU Central Committee to the 26th Party Congress).

The editorial staff has undertaken to make the magazine's headlines more precise and to deepen the selection of factual material this year after the publication of the decree of the CPSU Central Committee, the USSR Council of Ministers, the AUCCTU and the Komsomol Central Committee, "On Further Improvement of Economic Education and Training of the Workers." The EKO editorial staff has always considered the requirement advanced in this document "to contribute actively to the formation of modern economic thinking, socialist enterprising and businesslike behavior" to be one of the key requirements in its work.

#### New Headlines, New Ideas

Now a little about our plans for the near future.

We are on the eve of a remarkable event--the 60th anniversary of the founding of the USSR. Our December issue will be devoted to this. In it scientists from a number of union republics discuss the gigantic amount of progress that has been made by the economies of their regions during the years of soviet power. We think that it will be interesting to analyze the economic relations and ties among the republics and the peculiarities of their contributions to the unionwide treasury.

The USSR Food Program will occupy a special place in our plans. As for any press agency, the decisions of the May (1982) Plenum of the CPSU Central Committee were for EKO a broad and long-range plan of action. We have already published our first selection about the Food Program (1982, No 6). We hope that plant propagandists, lecturers and instructors at VUZ's will gain a certain advantage from this: Its authors deal with scientifically substantiated norms for the per capita consumption of products, show the complexity and interdependency of subprograms of the agro-industrial complex, demonstrate with the example of sugar beets the predictability in principle

of expected harvests, and raise a number of large issues that need to be resolved.

The editorial staff has a stockpile of material about the need for a system of machines for agriculture and the need to create a system for servicing these machines. We have prepared a selection of articles about one of the subprograms of the agro-industrial complex--the country's fishing industry (and fish provide 20 percent of all the protein that is consumed), and about the experience in commercial propagation of fish in bodies of water at industrial enterprises. In the future the magazine will have to provide information about a whole number of problems that combine the interests of industrial production and agriculture. These materials are now being sent to competent authors and being prepared for publication.

In 1983 we intend to initiate a new column--"Lessons in Leninist Style" or "Leninist Lessons in Administration" where we shall show how Vladimir Il'ich taught party personnel how to be businesslike and disciplined, how he felt about manifestations of bureaucratism and what he saw as ways of effectively fighting against them.

Next after the selection of articles concerning the experience of AvtoZIL will be the comprehensive experience of the RIGA VEF association, a discussion of the reconstruction of small enterprises and a continuation of the discussion of methods of selecting managers. We shall develop discussions about the enterprise's economic services, the figure of the engineer in the 1980's and 1990's and we shall begin a discussion of problems of price setting. The magazine also intends to further familiarize the readers with the experience of the CEMA countries and Yugoslavia, and also with the economics and organization of industrial production in developed capitalist countries. From the literature we shall refer to the translation of a small book by the American writer Art Bloch, "Murphy's Law" which has been prepared for publication. This is a kind of collection of aphorisms about the age of the scientific and technical revolution.

#### We Shall Return to the Readers' Wishes

This year at two readers' conferences--in Novosibirsk and Penza--we distributed a questionnaire in order once again to clarify the group of problems that most vitally interest our readers. The question was asked in the freest possible form and contained no restrictions: "Name one or two problems in our country's domestic life which most bother you personally." Those who responded were mainly management personnel of industrial enterprises and their economic services, workers of scientific research institutes and design bureaus, and instructors at VUZ's.

The most repeated variants of the responses had to do with labor problems. Here is a typical response: "We are bothered by the poor labor organization at certain industrial enterprises, which leads to low productivity."

The readers' responses show real concern. They raise issues of discipline, norm setting, payments, inadequate motivation for labor and demands on personnel. One of the responses says: "We pay not for labor, but for

difficulties which we ourselves create. As a result we solve immediate problems, but distort the long-term proportions and violate the very concept of payment for labor. To me personally this seems extremely dangerous."

In second place among the responses was the desire to see general economic indicators of the national economy growing at more rapid rates than they have recently. Those questions see the reason for this primarily in the situation of the local level of production--the industrial enterprise--and the slow implementation of decisions concerning improvement of the economic mechanism.

The third place in the questionnaire responses is occupied by the "problem of the manager." This pertains to selection, promotion, training and replacement of management personnel. The readers are bothered by the professional qualities of the managers, their moral levels, the criteria for selecting managers and advancing young people, and the labor collectives' control over the managers.

Somewhat unexpectedly for us, in a sufficiently high fourth place were issues regarding which the magazine has not taken a militant position in the opinion of the readers. They demand more intolerance of such phenomena as theft in industry and non-planned commodity relations. They also draw our attention to cases of distortion of statistical accounting which impede prompt adoption of the necessary measures.

These are the four most frequently repeated themes that were found in the responses to the questionnaires.

What other issues bother the participants in readers' conferences whom we questioned?

They would like to see more interest on the part of enterprises in scientific and technical progress; a more profound struggle against shortages as a fairly stable economic phenomena; better utilization of computer equipment; more discipline in plant deliveries and less randomness in the formation of human needs, correctly seeing in the last process an important description of the way of life. The readers' attention is also attracted by such issues as environmental protection, the evaluation and payment for the labor of workers of design bureaus and scientific research institutes, the prestige of higher education, the actual effectiveness of automated control systems, and many other things.

#### Participating in the Search for New Solutions

Somewhat conventionally and extremely broadly, everything published in EKO can be categorized according to four purposes: we recommend (advanced practice, advise); we discuss (statement of problems); we criticize (analysis of economic practice); and we inform and entertain (materials purely for information and diversion). The proportions of these in the overall annual output of the magazine have been as follows on an average for the last three years: we recommend--40 percent; we discuss--28 percent; we criticize<sup>1-12</sup> percent; and we inform and entertain--20 percent. These indicators have fluctuated in individual years, but their average is fairly stable. We consider

this ratio reasonable and the readers' responses confirm this. Additionally, the readers have an especially high estimate of that 12 percent of the material that gives analysis and constructive criticism of our economic activity. Why? They themselves give the answer to this in questionnaire and letters. Let us quote one of the letters: "Naturally, my colleagues and I do not read only your magazine, but we especially value it because on your pages economic science acts as to 'subvert complacency,' that is, it fulfills that role which Leonid Il'ich Brezhnev asked it to fulfill at the 26th Party Congress. We request that the editorial staff does not abandon this role."

We feel very supported by such letters. And we recall that the Congress recommended that science more courageously demonstrate the areas in which stagnation and backwardness have been observed, where the current level of knowledge makes it possible to advance more rapidly and successfully. We shall try to do this to the best of our ability.

While forming our subject plans for the future and preparing the next articles for the press, as usual, we await your advice and assistance. Above all, readers can help us in searching for advanced practice. Relying on party decisions and labor initiative, and crossing over departmental barriers and obstacles of the economic mechanism, sometimes taking serious risks, many collectives and their managers are achieving outstanding results. Their experience is public property and it must be interpreted and circulated. Tell us where this experience is being accumulated and about the collectives and the managers with initiative who should be discussed on the pages of EKO.

"We write and you print, but the shortcomings are still not eliminated," complained readers in some letters. This is not true. In recent years many good decisions have been adopted and implemented, and the main thing is that there has been a broad understanding of the immediacy of measures for improving the entire system of administration of the socialist economy. And the numerous press agencies have played an important role in creating this understanding, including our magazine, as have the letters from local areas, discussions and the reflections of economists that have been published in them. One cannot halt along this path, and therefore in the future we shall continue to expect suggestions, ideas and questions from the readers.

Now is a very interesting time: Many stereotypes of thinking are breaking down; we are searching for new concepts in the area of production planning and organization, labor relations, technical policies and attitudes toward the environment; and we are searching for new ideas regarding questions of demography, education, labor training and many other spheres. It is honorable, although not easy to participate in the search for new solutions. We appeal to our readers to participate in this.

The economy is the foundation of our common home. We shall persistently strengthen this foundation; both we and our children need a comfortable and solid home.

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## LASER R&D EXEMPLIFIES ZIL'S SCIENTIFIC-TECHNICAL WORK

Novosibirsk EKONOMIKA I ORGANIZATSIYA PROMYSHLENNOGO PROIZVODSTVA in Russian  
No 10, Oct 82 (signed to press 26 August 1982) pp 19-22

Article by Ye. P. Velikhov, academician, vice president of the USSR Academy of Sciences, winner of the USSR State Prize (Moscow): "An Important Element of the Country's Scientific and Technical Structure"

Text The USSR Academy of Sciences and its subdivisions are immensely interested in the production activity of the enterprises. In this connection, the experience in cooperation between scientific collectives and the AvtoZIL association is very instructive. Workers of the Institute of Electric Welding imeni Ye. O. Paton, the Institute of Economic Engineering imeni I. V. Kurchatov, the All-Union Scientific Research Institute of Metallurgical Machine Building, and scientists from MGU, MVTU imeni N. E. Bauman and other organizations are working at ZIL. What does this involve? Primarily the fact that ZIL has created a comprehensive system for accelerated introduction of developments. This is an actually operating system. ZIL takes good advantage of the possibilities of the socialist enterprise to apply scientific developments and thoroughly handles their introduction. And as we know, this introduction is not a simple thing.

And here is what attracts scientists to ZIL. A thing can be done much better or much worse, but it is very important to see the results of one's labor, to have the opportunity to blaze new trails in technical equipment and technology.

The material funds allotted to ZIL for stimulating science are not great.. We do a considerable amount of the work with our own money. Unfortunately, various kinds of material incentives for scientific and technical cooperation do not work at ZIL any more than they work in other places. But this has still not driven away the scientists.

There is no beacon for those who go in the vanguard. They must rely on their own experience alone. And the fact that ZIL tries to introduce what is new, what has originated in the laboratories, without fearing the risks or the difficulties, is a remarkable quality of the collective.

I established direct contacts with ZIL when laser technology was being introduced. The country has a special-purpose program for the development and introduction of laser technology. Here I have in mind both the less powerful

lasers of the Ministry of the Electronic Industry and the more powerful lasers of the Ministry of the Electrical Equipment Industry. The program indicates the goal of applying lasers and the legal bases for the development of new technology. The program, which will be fulfilled by 1990, envisions the production of hundreds of laser installations per year. Because of this we will be able to provide laser equipment for several dozens of plans each year.

A decision has been made to create a technical center for laser technology. A number of institutes are developing designs, and industrial enterprises are called upon to transform these ideas and developments into working instruments. Questions frequently arise in the process of implementing the program: Precisely which ministry will manufacture them, which will introduce them and which will finance the work? The Ministry of the Electrical Equipment Industry has earmarked scientific research welding institutes which are handling these problems and the first lasers have appeared, but no unified laser welding technology has been created and it is not known when it will appear.

It is obvious that a lot of time will pass before we begin to construct the technical center. Judging from everything, the Ministry of the Electrical Equipment Industry will be ready for this in the middle of the next five-year plan.

But time waits for no man. When one speaks of completely new technology, it is very important to proceed from the idea to the sale to the consumer as quickly as possible. The most eminent specialists have had many opinions about where the laser will go. Some have even said that the laser is not even necessary in the shops. And it was precisely then that technologists of the Automotive Plant imeni I. A. Likhachev saw an important task related to problems of welding which could be carried out with laser technology. After that, we and the plant specialists worked for two years on the creation of a laser installation and introduced a new system of automation. This became possible because our interests coincided with those of ZIL and the plant did not approach this problem simply from the consumer's standpoint. They thought not only about the immediate effect, but also about the prospects of laser technology. A special laser laboratory was created here which worked with all the plant's technological services.

The plans of the 11th Five-Year Plan earmark a broad area for the utilization of lasers in a whole number of technologies. The ZIL has taken a serious, realistic approach to the innovations and we are confident that they will be realized. For this is not simply the result of developments on paper. The testing of the processes at ZIL turned out to be an extremely important stage in the work. At the plant we saw that certain processes are difficult to introduce into mass production. There were also other reasons for rejecting them. At the same time the plant specialists suggested a sufficiently large assortment of technologies for introduction.

At the present time we have made a decision that the special laboratory created at ZIL will be the base laboratory for lasers. We will also be able to attract other organizations to this technological area and show the actual path to the introduction of this completely new technology into industry.

I have described our work with ZIL on lasers. But ZIL is actually unique because it adheres to a policy of scientific and technical research and the introduction of developments in a broad area. This is precisely why the USSR Academy of Sciences decided to expand the cooperation of many institutes with ZIL. Both parties--the presidium of the Academy and the association--have drawn up and approved a program for cooperation under the 11th Five-Year Plan.

One must say that the time periods for introduction at ZIL are quite incomparable with the traditional ones for the majority of enterprises. This is achieved because of the fact that the plant will take a risk, and we solve all problems jointly. Therefore we regard cooperation with the Plant imeni I. A. Likhachev, on the one hand, as a possibility of utilizing new technologies and, on the other hand, as an excellent testing ground which grants opportunities to verify scientific ideas in short periods of time. Everyone who is involved in scientific and technical progress understands how important this is: Until actual specifications and conditions for the application of new technology are developed, the Gosplan will not allot capital investments for one job or another. And it is impossible to work without funds. Therefore one has a vicious circle. But ZIL makes it possible to break this circle. Today the condition of our science and industry is such that there is no area where we cannot solve the problems that arise through our own forces. But in order to develop all areas it is necessary to verify and operate as quickly as possible. Here, of course, the main thing is to reduce the distance from the idea to the production process. Therefore we regard the future of cooperation between ZIL and the USSR Academy of Sciences as a way of finding the most effective area for cooperation. In this connection there is one principle wish. It would be good if the Ministry of the Automotive Industry regarded ZIL not only as a producer of motor vehicles, but also as an exceptionally important element in the scientific and technical structure of the Soviet Union and would help it in its scientific and technical research.

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## ZIL SCIENTISTS BRIDGE RESEARCH, DEVELOPMENT GAP

Novosibirsk EKONOMIKA I ORGANIZATSIYA PROMYSHLENNOGO PROIZVODSTVA in Russian  
No 10, Oct 81 (signed to press 26 August 1982) pp 23-32

Article by S. V. Gorikhin, deputy head engineer of the ZIL Production Association (Moscow): "Intensification of the Process of Introduction"

Text In cooperation with scientific centers of the country our association is developing a system for accelerated introduction of the achievements of science into production. What distinguishes this from traditional forms of cooperation between enterprises and scientific institutions?

Previously scientific research laboratories, technical services and divisions of ZIL concluded agreements for creative cooperation with science (or autonomously financed agreements) for the development of individual projects. The development went as far as the experimental models, and then the cooperation ended. Through its own efforts the plant brought the innovation to the point of industrial utilization. The time periods for their implementation were prolonged since difficulties arose and mistakes were revealed which could not be changed under laboratory conditions or on the experimental model, and were discovered only during introduction.

In order to step up the influence of science on production, it was necessary to facilitate the movement of the scientific idea to its industrial utilization. We saw a possibility of intensifying the process of introduction by continuing the chain of cooperation from development to realization in the shops. Science was willing to adopt this form of cooperation which is advantageous to both parties: Scientists are interested in the materialization of their ideas, and the association--in increased effectiveness of production.

In order to coordinate the work between the institutes and the association and also to exercise control over the prompt realization of development, ZIL drew up a complex of organizational measures which we regard as a system for accelerated introduction of the achievements of science into production.

The first point in the system consists in that the participation of the institutes does not end with the submission of scientists' recommendations or an experimental model, but extends to the stage of introduction. Scientists in conjunction with plant specialists bring their developments up to the point of industrial application.

Second: cooperation was organized on a clear-cut planned basis. While previously particular problems were solved, beginning with the 10th Five-Year Plan five-year comprehensive programs have been drawn up for cooperation with leading scientific centers on joint scientific research projects. The programs are included in the association's five-year plan for scientific research and experimental design work. On the basis of these annual plans are created which are supported with material, labor and financial resources. The comprehensive plan determines the problem, and in the annual plans each job is listed according to stages and performers. We have two kinds of cooperation with science: creative cooperation and the economic agreement. Frequently joint research begins with creative cooperation, and when the stage of material embodiment of a scientific idea is reached, we conclude an economic agreement for the manufacture and introduction of installations, items, technologies and so forth.

Third: Accelerated introduction is promoted by the existence of a special unit that links science and production. This unit is the ZIL scientific center which has a complex of engineering and technical services, scientific laboratories, specialized design divisions, large-scale instrument production and its own production of equipment. It has the necessary scientific potential (there are two doctors and 50 candidates of sciences working in the association). This makes it possible to set clear-cut tasks for scientific organizations, and also to give an authoritative evaluation of the practical prospect of one scientific development or another and the possibilities of its application at ZIL.

The scientific subdivisions of ZIL have not been formed into an independent scientific research institute. Organizationally they are closely connected to services and productions of the head plant and other plants of the association. Each scientific and engineering and technical service has its own production base. The division of the head designer for automotive construction, the administration of the head metallurgist for forging, the administration of the head metallurgist for smelting, the division of the head designer for machine tool building, the service of the head designer for furnace equipment and thermal instruments, and others also have them. This provides profound knowledge of the interests of production. Embracing scientific ideas, the services themselves design, manufacture and operate the new technical equipment, that is, they bear responsibility for the introduction of the scientific and technical innovation from the beginning to the end of the chain.

And, finally, fourth: the development of new organizational forms for control of scientific and technical progress. In order to determine the subject matter of comprehensive programs, working groups are created from specialists of scientific organizations and the association. They study the need for certain forms and the potential possibilities of other forms directly in the plants of the association and in the institutes, and only after this do they formulate the subject. The economic effectiveness and the expediency of the developments are confirmed by calculations that are made according to methods approved in the association. We have created a bureau for technical and economic calculations concerning new technical equipment in the division for preparing for production and a group for technical and economic substantiation of designs for motor vehicles in the division of the head designer. But

methodologically they are subordinate to the deputy director for economics, in whose hands all calculations of the effectiveness of new technical equipment are therefore centralized.

Coordination and control over joint developments under comprehensive programs are provided by a unified working agency (staff) consisting of specialists and managers of one institute or another and the association. This agency for special-purpose program control successfully augments the organizational structure of the association without violating or changing the existing linear structure or administrative ties.

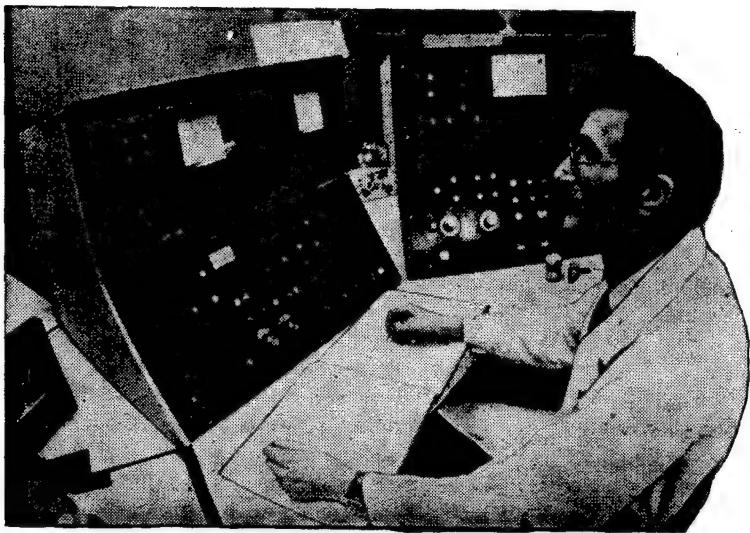
In order to implement the developments, joint orders are issued for the institute and association. These determine the volume of work, the time periods and the individuals who are to perform it.

Efficient utilization of the possibilities of the association and the scientific organizations is promoted by cooperation in the manufacture of experimental models, equipment and so forth. Thus we are introducing, for example, a continuously operating gas laser which was developed under the leadership of academician Ye. P. Velikhov. ZIL manufactured a discharge chamber for the experimental model of the laser, for which complex mechanical processing was necessary. The optics, the source of feeding and other units were manufactured by the Institute of Atomic Energy imeni I. V. Kurchatov.

In the stage of manufacture of experimental models we create complex design-technological brigades with the participation of scientific organizations. The client and the performer of the work are joined by a common goal. All this makes it possible to manufacture the experimental model in short periods of time, and to conduct more careful testing of it and fuller development of designs or technologies, which reduces the time period for the introduction of new technical equipment into production.

The participation of the scientific organization in industrial introduction gives the advantage to the new system over the previously existing practice. With a large batch of parts it is possible to investigate such properties of the technology or design as reliability and resistance to wear and tear, which are not revealed, as a rule, in the experimental model. It is here that the combination of the practical experience of plant specialists and the scientific potential of institute specialists is particularly useful. The necessary decisions are made on the spot and additional improvements are made to the design of the equipment, instrument or technology. Here there is an advantage both in time and in the insurance of the reliability of the technical equipment or technology.

Regular direct contacts between managers and head specialists and chiefs of laboratories and design bureaus of the association, on the one hand, and leading scientists, on the other, contribute to a situation where the latest reliable information about valuable scientific ideas, inventions and discoveries comes to us even before publication, that is, 1.5-2 years before it arrives through the usual channels, and we can accelerate its utilization.



Large robots for improving the thermal processing of universal joint center crosses are being introduced into the service of the head metallurgist of the forging and thermal productions. In the photograph: examination of the structure of the metal after thermal hardening in the central physics laboratory.

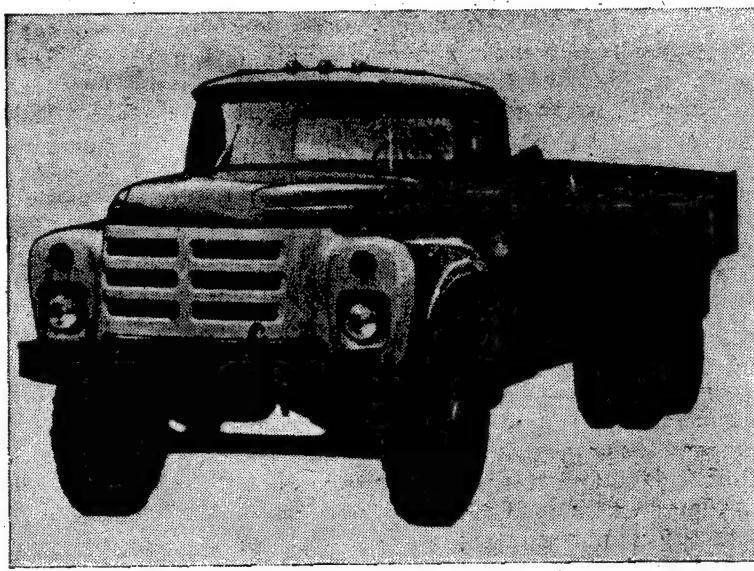
ZIL cooperates successfully with scientists of many institutes. At the suggestion of the president of the USSR Academy of Sciences, academician A. P. Aleksandrov, a program was developed for scientific and technical cooperation between the USSR Academy of Sciences and ZIL for 1981-1985. The most important subjects were established by the presidium of the Academy of Sciences. Instructions were published indicating that the institutes are responsible to the presidium for their fulfillment. ZIL is conducting joint scientific research developments with a total of 113 scientific organizations on 420 subjects, of which 270 subjects are being handled on the basis of cooperation.

Thus we have succeeded in placing interrelations between science and production, which were previously temporary and random, on a stable long-term basis and creating a mechanism for interaction which makes it possible to accelerate the realization of scientific and technical potential. The time periods for the introduction of development have been reduced by 2-3 years or by an average of one-half. Thus, while the development of new brands of steel in domestic and foreign practice usually requires 5-7 years, for us this process lasts approximately 2.5 years, with a significant savings on material resources and capital investments.

In short periods of time, in conjunction with scientists of the scientific research institute for automotive tractor materials, we developed a composition of steel for manufacturing heavy-weight gears for the rear axles of ZIL and KamAZ trucks. As a result the durability of the parts increased by 30 percent and the annual economic effect exceeded one million rubles. In conjunction

with the Moscow Machine Tool Instrument Institute and a number of metallurgical plants, the ZIL completed a complex of work for creating stamping steel, whose application increases 1.5-2-fold the sturdiness of stamps, press forms and instruments for the technology of cold smelting of parts and billets, and will make it possible to save 1 million rubles.

The results of the development of cooperation with science are manifest. The economic effect from the output of modernized motor vehicles, the introduction of progressive technological processes and measures from science and new technical equipment amounted to 130 million rubles during the 10th Five-Year Plan. During the past five-year plan the new ZIL-133 G Ya motor vehicle has been put into production. Its cargo capacity has been increased to 10 tons and in a truck train it can haul up to 18-20 tons of cargo. The vehicle is equipped with a KamAZ diesel engine which is more powerful and operates on less expensive and more economical diesel fuel. A design has been developed for promising new ZIL-169 trucks with ZIL diesel engines. It has undergone state testing and has been approved for series production. Our most distant enterprise, the Chita plant, has assimilated the production of trucks for use in the North.



The ZIL-133 motor vehicle which you see in the photograph has been awarded the State Emblem of Quality. The vehicle is more economical than previous models since its engine does not operate on gasoline, but on less expensive diesel fuel, and it has a greater cargo capacity.

The ZIL-130, ZIL-131, ZIL-133 G Ya motor vehicles, the U-shaped engines (we deliver them to the Ural'sk and Kutaisi automotive assembly plants and the Lvov and Likino bus plants) and also our household refrigerators have earned

the State Emblem of Quality. Items of the highest quality category comprise more than 70 percent of the association's output.

The influence of the scientists has been reflected in the higher levels of scientific and technical developments of the automotive plant workers themselves. During the 10th Five-Year Plan the association submitted 753 applications for inventions. About 500 innovations were recognized as inventions and introduced. The economic effect from invention and efficiency work amounted to 32 million rubles during the five-year plan.

Cooperation with science made it possible for automotive plant workers to adopt for the 11th Five-Year Plan special-purpose programs directed toward maximum economy of labor, material and energy resources, toward improved quality, efficiency and durability of products that are produced, and toward the introduction of labor-saving and principally new industrial technologies. They have planned 46 scientific developments in conjunction with scientists of institutes of the USSR Academy of Sciences, the Ukrainian SSR Academy of Sciences, MGU, MVTU, Scientific Research Institute of the Automotive Industry, the ZIL plant vocational and technical training institution and other scientific centers. On the basis of these programs ZIL formulated socialist commitments which were approved by the CPSU Central Committee.

In our programs for economizing on labor, material and energy resources, it is possible to single out the following measures:

improving the quality and the effectiveness of products that are produced;

introducing principally new technological processes that are based on the application of highly concentrated sources of energy--laser, electron ray, plasma;

comprehensively mechanising and automating production, and extensively applying robot equipment;

introducing reduced-waste technology;

applying a program for economizing on heat and energy resources.

The programs for economizing on metal and new technologies are discussed in detail in articles published in this selection by our head specialists for metallurgy and welding, V. D. Kal'ner and M. M. Fishkis. I shall briefly discuss other areas.

In the area of improving the designs of motor vehicles and increasing the economy of their operation, under the current five-year plan we are solving the following problems. We must prepare capacities for producing new diesel motor vehicles, and in order to do this it is necessary to expand and reconstruct existing capacities and introduce new ones. Using diesel engines in motor vehicles opens up a new page in the history of ZIL. The country's oldest automotive plant is beginning to produce more economical motor vehicles, whose utilization will make it possible to save 2 million tons of liquid fuel a year.

A large effect is expected from the introduction into production of designs of the ZIL-138 gas cylinder motor vehicle, which uses liquified and condensed gas instead of liquid fuel which is less available.

A number of measures related to new technical equipment are directed toward improving products that are produced in series. As a result of their introduction the operating time before capital repair of the ZIL-130 motor vehicle should increase by 16 percent and that of the engines--by 20 percent, and the norms for the expenditure of fuel for the ZIL-130 motor vehicle should decrease and provide for saving 0.5 liters of gasoline per 100 kilometers of travel.

The program for economizing on energy resources consists of three areas: the application of more economical equipment; the introduction of energy-saving technologies; and the utilization of secondary resources. A complex of measures have been approved for introducing energy-saving technologies which should provide for saving 15 percent of the electric energy consumed by the association or 230 million kilowatt-hours, and 5 percent of the fuel or 45,000 tons of conventional fuel a year. Among the economical kinds of equipment are machine tools for rolling parts which are being created in cooperation with the Institute of Metallurgical Machine Building of the USSR Academy of Sciences, headed by academician A. I. Tselikov. The billets obtained from them are as close as possible to the parameters of the parts and eliminate many energy-intensive processes of mechanical working.

We have already begun to utilize secondary heat by installing rotating heat exchangers in the shops. Our specialists developed the design for them. Because of them the annual savings on heat will be 45,000 gigacalories.

The new system of cooperation with science is a good organizational basis for carrying out the tasks that have been earmarked.

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## WAYS TO REDUCE USE OF METAL AT ZIL EXPLORED

Novosibirsk EKONOMIKA I ORGANIZATSIYA PROMYSHLENNOGO PROIZVODSTVA in Russian  
No 10, Oct 82 (signed to press 26 August 1982) pp 32-40

[Article by V. D. Kal'ner, doctor of technical sciences, professor, winner of USSR State Prize, head metallurgist: "An Effective Area for Economizing on Metal"]

[Text] Efficient utilization of metals is one of the main areas in the technical policy of AvtoZIL. Since the beginning of the production of the ZIL-130 and ZIL-131 motor vehicles we have assimilated and introduced a large number of design and technological measures which, within the framework of traditional technological processes, have almost fully exhausted the basic reserves both for reducing the expenditure of metal and for reducing the labor-intensiveness of the manufacture of motor vehicles. Individual productions have achieved a relatively high coefficient of utilization of metal (KIM). For example, the forging shop and the spring production at ZIL have the highest coefficient in the branch--0.81. But for thermal productions in the association as a whole it is about 0.65.

A further significant increase in the KIM is a key issue in introducing the so-called reduced-waste technology. We have decided to use this term for a new area in our work, in which we are cooperating with science and whose goal is to economize on all kinds of raw material, and metal above all. I should like to share with you what we ZIL workers understand as reduced-waste technology, what it provides for the association and the national economy, what is required for its implementation and why it seems to us that this work deserves the attention of other branches of the national economy and a number of state institutions, primarily the USSR Gosplan, Gosnab and Gosstandart.

We have not discovered new kinds of energy or principally new materials and we have not developed previously unknown technological processes. But still one can boldly assert that we are speaking about a principally new approach to the technology of manufacturing parts under the conditions of large-series and mass production. It is based on an in-depth engineering analysis of the entire process of creating machines or mechanisms: from the production of the billets (or more precisely, from the initial material) to the finishing operations and control over the prepared item.

Let us take a relatively simple example: The production of billets for gear shift shafts by cross wedge welding instead of hot stamping. The process was developed by the All-Union Scientific Research Institute of Metallurgical Machine Building under the leadership of academician A. I. Tselikov. It produces a significant savings on metal and at the same time makes it possible to eliminate further mechanical processing of the parts by turning. The billets are so close to the final parameter of the part that they need only to be polished. True, the polishing machine tool and its instrument must be reconstructed since with identical geometric precision the rolled billet will be different from the one obtained by the turning method. This example shows that the introduction of reduced-waste technology requires a comprehensive approach. It is advantageous for saving metal and increasing labor productivity, but it makes it necessary to take a number of design, technological and organizational-technical measures directed toward developing a unified technology for manufacturing the part.

In order to increase the coefficient of the utilization of metal in the association to 0.8-0.86, in conjunction with other enterprises of the Ministry of the Automotive Industry, Ministry of the Machine Tool and Tool Building Industry, the Ministry of Heavy and Transport Machine Building, the MGU, institutes of the Ukrainian SSR Academy of Sciences, the Institute of Atomic Energy imeni I. V. Kurchatov and the All-Union Scientific Research Institute of Metallurgical Machine Building, we have earmarked and are conducting a complex of scientific research and planning-design work for improving the technology of forging-pressing, smelting, welding, machine processing and instrument production, and also for changing the designs of parts and components of motor vehicles.

We are increasing the volume of output of precision hot stamped billets with minimum wastes. Reduction of the metal expenditure, increased productivity and improved working conditions are achieved as a result of the introduction of machine tools for cross wedge rolling, stamping toothed wheels, automated multipositional hot pressing machines, stamping in matrices on automated lines, and improved cutting of billets. These technological conditions will be provided on automated or automatic lines for hot stamping. People will be released from difficult working conditions.

The utilization of parts manufactured from metallic powders is increasing sharply. It is intended to construct a shop for powder metallurgy with an output volume of 10,000 motor vehicle parts a year. We have arranged good cooperation with the Tulachermet scientific production association and the Dimitrovgrad automotive parts plant of the USSR Ministry of the Automotive Industry. We receive powders and a number of metal ceramic parts from them.

We are changing over on a large scale to manufacturing large billets with cold and semi-hot drop forging. To do this it seemed that known technology required creating a new brand of steel. Plant specialists in cooperation with scientists developed this on a high technical level. It is patented and protected by an author's certificate for invention. It was also necessary to develop new processes for hardening the parts.

We have also begun to apply combined stamped and welded billets with complex configurations. They are welded together from two relatively simple parts, each of which is obtained with reduced wastes of metal and minimum allowances for subsequent mechanical processing.

We are preparing to change some of the forged billets with a low coefficient of utilization of metal from stamping to smelting from steel and highly durable iron, using progressive processes of continuous smelting, smelting in ceramic forms, and so forth. To this end the association is creating additional capacities at the Mtsensk plant for aluminium smelting and the Yartsevo iron smelting plant is being constructed. We are also expanding the production of parts made of aluminium alloys by the method of press smelting on machines with cold or hot chambers for pressing instead of casting from iron and aluminium shell mold casting, which reduces the expenditure of metal and the volume of mechanical processing.

We shall initiate a process called "smelting-stamping." We have begun to use this method to make brass wheels of the synchronizers, which were previously manufactured from costly rolled tube metal.

These areas for saving on metal are related to two traditional ones: the development and application of highly durable steels or steels with special coatings and new kinds of thermal processing that make it possible to reduce the weight of the parts without reducing their sturdiness. Much of this has already been done. For example, for the first time in world practice we have introduced technology for thermal processing of springs using induction heating in various stages of the hardening. We are saving 20 kilograms of metal just on the manufacture of rear springs for the ZIL-133 motor vehicle. Working conditions have improved essentially and 6 workers have been released.

What economic results are expected from the measures that have been earmarked? Calculations show that the expenditure of metal in the association will decrease by 120,000 tons a year. The average coefficient of the utilization of metal in billet production will increase to 0.83. The effect should be significant in the sphere of economizing on labor resources as well. Working conditions for workers in the billet shop will improve significantly, the nature of their labor will change, there will be new occupations that require higher qualifications and a higher educational level, and there will be a sharp curtailment of manual operations. As a result of reducing the labor-intensiveness of the manufacture of billets and parts by methods of reduced-waste technology it is intended to release 1,500 people who will be employed in places where there is a shortage of personnel. And there are many of these places at ZIL.

Complete implementation of what has been earmarked will depend both on the ZIL workers and their partners in scientific and technical cooperation, and on many enterprises and supplier branches as well as planning and control agencies. So we will have to assimilate and introduce a large quantity of highly productive automated equipment, including 90 types of principally new, special equipment. It should be created and delivered to ZIL by a number of branches. In our opinion, the initiative of the Voronezh production association for heavy mechanical presses deserves approval and dissemination. It has changed over to

batch delivery of automated lines and complexes which are fully supplied with domestically produced equipment.

We have concluded an agreement for socialist cooperation with the Voronezh production association. In conjunction with the Voronezh workers we will create a large forging shop that meets all modern requirements. Our cooperation is principally different from the old forms in that the manufacturer is responsible for more than prompt deliveries; he is also responsible not only for the output of the latest equipment and the startup of capacities, but also for the achievement of the planned technical and economic indicators in the shops. This kind of cooperation which has a common goal--achieving final results more rapidly--is a step toward completely new kinds of relations between the client and the manufacturer. Other enterprises of the machine tool building industry, unfortunately, are slow in rearranging their relations with the clients.

ZIL has arranged good business relations with the All-Union Scientific Research Institute of Metallurgical Machine Building scientific production association. On the basis of the machine tools for cross wedge rolling that were created there, with their help we have introduced comprehensively mechanized lines for manufacturing gear shafts, ball pins and other parts.

Name of Part	Pump stator of hydraulic booster wheel	Pump disk of hydraulic booster wheel	Bearings of steering rods	Bearings of torque rods	Flange of thrust camshaft	Shock absorber parts	Oil pump pinions
Billets obtained by hot stamping or from bars							
Coefficient of utilization of metal in manufacture of parts with existing technology	0.51	0.61	0.38- -0.41	0.43	0.51	0.21- -0.33	0.31
Billets obtained from metallic powders							
Coefficient of utilization of metal in manufacture of parts by method of powder metallurgy	0.82	0.90	0.95	0.95	0.85	0.90	0.84

When speaking of reduced-waste technology one cannot but discuss the fact that its introduction and extensive application are impeded to one degree or another. Everyone knows the advantages of manufacturing parts from metallic powders. In our list of products when 1,000 tons of parts are manufactured from powders we save 1.8 thousand tons of rolled metal, and release 70 workers and 50 machine tools for mechanical processing. So why has this method of manufacturing parts not been applied extensively in machine building so far? In our opinion, there are several reasons. First, the production base of ferrous metallurgy for producing metallic powders is weak, the list of powders is limited and their quality is poor. Second, the cost of powders is incredibly high, especially alloys, as compared to rolled metal. Frequently the change is economically unjustified. Third, the production of special presses and other equipment for manufacturing parts from powders (sintering furnaces, mixers and so forth) is poorly arranged.

There are also other problems with economizing on metal whose solution depends on the Ministry of Ferrous Metallurgy. We have in mind, for example, the utilization of high-grade continuously smelted billets, that is, those obtained by smelting without rolling. They can be used successfully for hot stamping of parts. We understand that the quality of continuously smelted billets is not always equal to that of hot rolled metal. But if the Ministry of Ferrous Metallurgy would work to improve their quality and if machine building would use them efficiently (applying methods of wedge or rotary rolling for obtaining parts), the state would save a great deal of metal. Our experience with the Tulachermet scientific production association demonstrates the possibility and expediency of using continuously smelted billets for manufacturing a number of automotive parts by the hot stamping method.

Another problem on which we shall have to work in conjunction with metallurgists is increasing the corrosion resistance of the parts of the bodies of the motor vehicles. We need zinc coated steel sheet metal, which could be obtained by multiple stamping and especially by multiple stretch fuming. Moreover, the parts from this sheet metal should be welded well with precision contact welding. These requirements are met by electrolictically zinc coated sheets of steel with differentiated coating. So far ferrous metallurgy enterprises do not produce this kind of sheet metal.

Our specialists have calculated that by using zinc coated sheet metal it would be possible to reduce the thickness of the body parts by 10 percent. In our association alone this would save about 2,000 tons of cold rolled sheet metal a year with a simultaneous increase in the service life of the bodies of the vehicles. The technical and economic effectiveness here is obvious.

The motor vehicles we produce have a muffler which begins to malfunction relatively quickly. As the drivers say, it "burns out" as a result of the effects of the exhaust fumes. ZIL engineers, in conjunction with scientists of the Ukrainian Scientific Research Institute of Special Steel, conducted research which showed that the sturdiness of the muffler can be doubled and the weight reduced by 2 kilograms if it is manufactured from sheet steel coated with a fine layer of chrome. The work was completed two years ago but it has not been introduced yet even though the technology for vacuum chrome plating of steel sheets has been developed by specialists of the Ukrainian Scientific Research Institute of Special Steel and they have also created a design for an industrial installation.

Striving to bring the work to the point of introduction more rapidly, ZIL has agreed to render technical assistance in the manufacture of a number of components for the installation for vacuum chrome coating. But one might ask if it is really only ZIL that needs a light-weight sturdy muffler. According to our data, sheet steel manufactured according to the technology for vacuum chrome plating can replace costly non-rusting steel in a number of cases.

Writing in IZVESTIYA academician B. Ye. Paton discussed the creation of so-called service centers--intermediate enterprises between the producers of metal and its consumers, whose task would include a kind of "completion of processing" of metal products, that is, improvement of their consumer qualities.

With one brand of steel or possibly a group of brands, the intermediate enterprises could sort them within a narrow range of mechanical and technological properties. The delivery of products in narrow guaranteed ranges of characteristics could produce a significant savings on metal.

The creation of sets of equipment with large unit capacities at ferrous metallurgy plants and the increased concentration of all metallurgical production will inevitably lead to a situation where the consumer receives some quantity of metal that does not meet the requirements of technical specifications and state standards. This phenomena is so widespread that even certain standards for metal products allow the expression: "The batch is considered to meet the corresponding requirements if the number of units that do not meet the requirements on the surface does not exceed 5 percent . . ." But it is precisely this surface that determines the percentage of rejections during sheet stamping and painting of the vehicles. How can this be? The defect is legitimized . . .

The fact that a number of state standards allow the delivery of rolled metal of the wrong length (so-called "shortees") is also worthy of the attention of the USSR Gosstandart. They are practically unusable in modern systems of flow-line automated cutting. As a result much metal must be remelted. Is there a solution to this? In our opinion, metal of the wrong length could be used in small-series or piece production. And it should be sorted and sold, possibly, by those same service centers that are attached to the largest metallurgical combines.

We recognize that reduced-waste technology is still a long way from waste free. It cannot be regarded as ideal. Consequently, work for improving technology should and will be continued. ZIL workers see another reserve for saving on metal in replacing it with other materials. Plastic items are not being used extensively enough, including in automotive construction. In conjunction with scientific institutions we shall continue work in all areas of economizing on metal.

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CSO: 1820/10

## USE OF LASERS, ROBOTS IN AUTOMATING ZIL PRODUCTION DISCUSSED

Novosibirsk EKONOMIKA I ORGANIZATSIYA PROMYSHLENNOGO PROIZVODSTVA in Russian  
No 10, Oct 82 (signed to press 26 August 1982) pp 41-50

Article by M. M. Fishkis, winner of USSR State Prize, candidate of technical sciences, head welder: "Cooperation in the Area of New Technologies"

Text Science can reach production by many paths, but the shortest and most reliable of them, as our many years of experience show, is direct contact between scientists and the enterprise. Then scientists enrich production with new technical ideas, and the production collective searches for ways and means of introducing them and formulates new scientific and technical tasks. Specialists of the plant scientific center who are participating in the implementation of new ideas know what production especially needs and what technical difficulties exist in the introduction of the development. They are equal partners of the scientific organization and a necessary unit in the cooperation between science and practice.

I shall discuss several technological innovations that originated as a result of this cooperation. They are apparently of interest to machine building enterprises. They include the creation of principally new processes based on the application of highly concentrated sources of energy--laser, electronic beam, plasma--and the development of labor-saving technologies and automation of production.

### Miracle Beam

Five years ago, with the help of the Institute of Atomic Energy imeni I. V. Kurchatov and the Moscow State University, ZIL created a central laboratory for electronic beam and laser processing of metals. At our request academician Ye. P. Velikhov recommended one of his students to lead it--candidate of physics and mathematics, V. M. Andriyakhin. He turned out to be a businesslike person and quickly entered into the plant's problems. All this predetermined, to a considerable degree, our success in the area of the assimilation of laser technology. Suffice it to say that now our laboratory has become the base laboratory of the USSR Academy of Sciences. Such a form of integration of science and production bears witness to the Academy's recognition of the role plant science.

The gas laser with continuous operation that was developed under the leadership of academician Ye. P. Velikhov has unique capabilities because of the high concentration of energy. The beam focuses well with a lens and is easily directed toward a particular section of a part with the help of a mirror. This is also the basis for the process of nondeforming laser hardening of working surfaces of parts that are subject to the greatest wear.

Not all of the part is heated, but only that part of it which determines the working capability of the surface layer. As a result there is no deformation and there is no need for polishing or other additional processing. With thermal processing in a furnace or high-frequency current (TVCh) one cannot avoid deformation.

With the use of the laser the heated zone of the metal is small and the item itself is a powerful channel for the release of heat, and therefore there is no need for an additional environment for cooling (oil bath or water shower). The speed of cooling is high (like the speed of heating), which has a favorable effect on the heat resistance and the resistance to wear of the layer that has been hardened with the laser.

The laser makes it possible to have precise amounts of energy introduced into the metal as a result of the precise focusing of the beam, the energy capacity, the speed of the process and other parameters which can be controlled. As a result laser tempering can be done without glazing the surface. We have also achieved good results with laser tempering of parts made of iron and aluminium alloys. Since no mechanical processing of the parts is required after laser tempering, this process can be included in the operative technological line as a finishing operation. As is shown by more than two years of practice, the hardness of the stamps and the instruments which are tempered with a laser increased 2-4-fold, depending on the properties of the metal and the form of the stamped item.

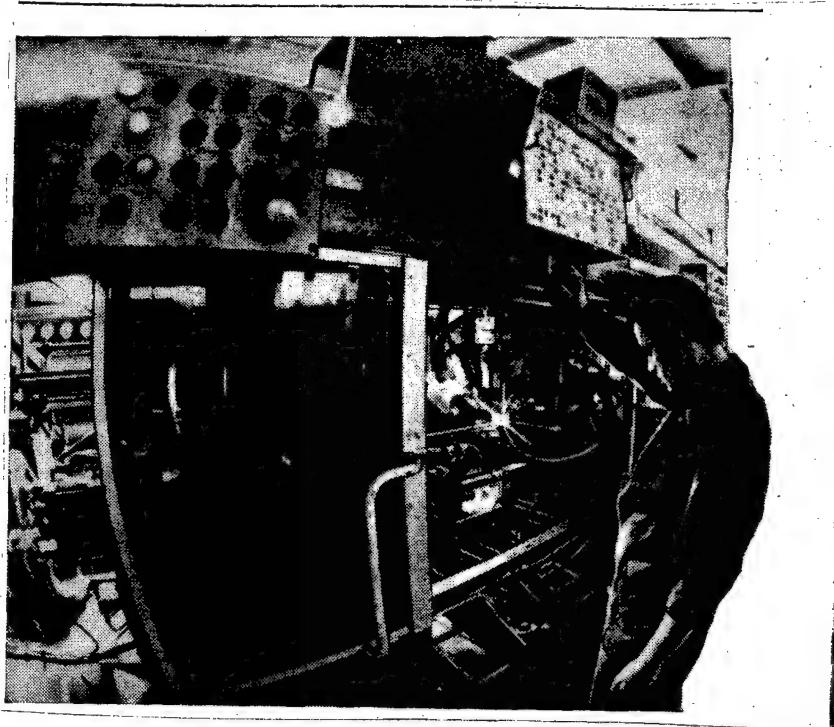
We are introducing laser hardening of heads of blocks made of aluminium alloys. Their resistance to wear increases 2.5-fold. We have completed the development of blueprints for an automatic line. It will be equipped with four lasers that are being manufactured in the Institute of Atomic Energy. It is important that this line be included in the flow of automated lines for mechanical processing of the heads of blocks without disturbing the existing process. We intend to install it in 1983.

The utilization of laser hardening of parts made of iron is of special interest. Using precise amounts of energy in the laser beam, which is achieved by controlling its capacity and speed of movement, makes it possible to temper the iron. And it, as we know, cannot be tempered by ordinary methods. It is precisely this that explains the fact that iron is most frequently used in machine building without tempering. Research we conducted showed that ordinary grey iron tempered by a laser beam reaches excellent hardness (increasing 3-fold) and its wear under friction decreases sharply. The technology developed at the plant for laser hardening of casings of cylinder blocks made of ordinary grey iron makes it possible to eliminate the use of costly insets in the surface part of the casing made of a heat resistant iron alloy, which include nickel, copper and other alloying elements that are in short supply.

Laser welding opens up quite new possibilities. Our partners in introducing this were the Institute of Electric Welding imeni Ye. O. Paton of the Ukrainian SSR Academy of Sciences and the MVTU imeni N. E. Bauman. Laser welding of short Cardan shafts on trucks provides for great precision: The amount of error is so insignificant that it is not even caught by measurement instruments.

Laser form cutting of thin metals (with a thickness of 0.5-2.5 mm) is promising. Gas-heat and plasma cutting are unacceptable for such thicknesses since a solid welding edge is formed, which is very difficult to remove. Moreover, the laser beam makes it possible to obtain a very fine cut since it is possible to focus the diameter of the beam to 0.1 mm.

In conjunction with the All-Union Scientific Research Institute of Gas Welding and Cutting of Metals, we are working on the creation of a laser installation with programmed control for cutting metal. Automation of the process of cutting is becoming a reality. It seems that if ZIL were to work on the introduction of laser technology alone this would require no less than 10-15 years. And the Institute of Atomic Energy would also have to spend more time and effort in order to find technological solutions for the application of lasers in industry. The cooperation of science and production has reduced at least by half the time period for realizing a great scientific achievement.



Laser installation for welding Cardan shafts at the Cardan shaft plant of the ZIL Association.

Each week we, along with scientists of the Institute imeni I. V. Kurchatov and the MVTU imeni Bauman, discuss the results of the work that has been done and consider problems that have arisen. This is a new form of purely business cooperation. The work proceeds efficiently. Yevgeniy Pavlovich Velikhov visits us very frequently. If he cannot come he telephones: "Will you permit me not to come today?" Such a curious trait. He probably characterizes the interest of a scientist in cooperation with production.

#### In Order to Prolong the Life of the Parts

Everyone who is involved in the operation of a motor vehicle, even those who are not directly engaged in it, know the immense difficulties that arise when replacing worn-out parts and components. The problem of providing spare parts is crucial both for the branches of machine building and for all organizations involved in the operation of equipment. It has reached the national economic level. When speaking of ways to solve it one constantly emphasizes the need to increase the volume of spare parts that are produced. At ZIL as, probably, at many other machine building enterprises, there are no free capacities or other resources for expanding the output of components and parts. Therefore we are seeking other solutions: prolonging the life of the parts of the motor vehicle and refurbishing those that are worn out. Science is rendering a great deal of assistance in this search.

The development of processes of gas plasma, plasma and blast spraying have turned out to be extremely promising. Because of them, as a result of applying a thin layer of coating, one achieves a considerable improvement in the service properties of the surfaces of various parts and machines. These processes are sometimes applied in the manufacture of new parts and instruments, but mainly they are used for repair and refurbishing. Thus plasma surfacing of motor vehicle valves with a heat resistant alloy, which was developed and introduced in conjunction with the Institute of Electric Welding imeni Ye. O. Paton of the Ukrainian SSR Academy of Sciences, made it possible to double the service life of the valves.

The research conducted in conjunction with the Scientific Research Institute of the Automotive Industry demonstrated how promising it is to apply coating by the blast method. The wear resistance of the water pump after blast coating with aluminium oxide increased 4-fold. Blast coating is to be introduced at ZIL in 1983.

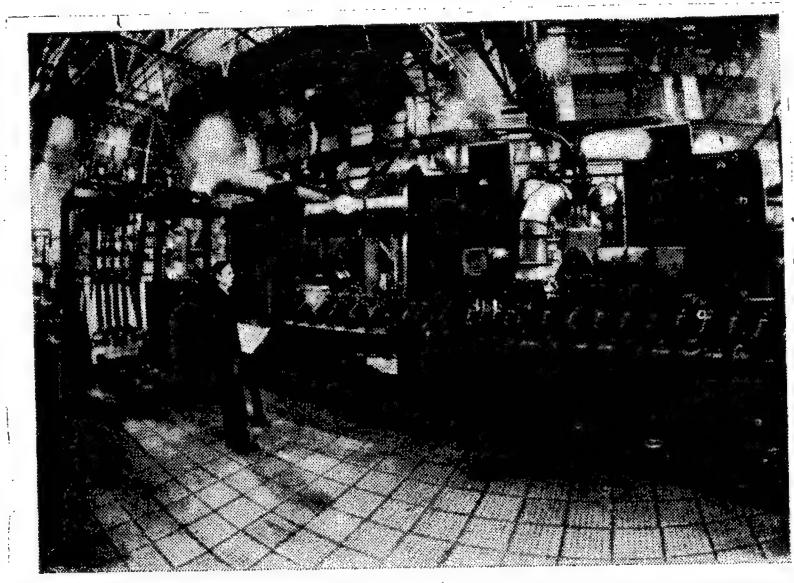
It is intended to make extensive use of processes of spraying and surfacing for refurbishing engines. A principally new technology for capital repair has already been created. In 1982-1984 it will be assimilated at the Simferopol plant of our association. Calculations show that it is possible to double the life of an engine as compared to the amount of time produced by traditional repair methods.

#### The Robot Should Come to the Conveyor

With respect to robot technology the cooperation with science is somewhat different. A situation has arisen wherein, it seems to me, science is greatly indebted to the country. Work on the creation and introduction of industrial

robots has been in progress for almost 10 years, but they still have not completely developed a reliable design for the conditions of mass production.

Designers of the Leningrad Polytechnical Institute, which has been appointed the head institute for robot technology, have certainly not done everything they can. They were supposed to have developed 3-4 standard robots during these years and submitted them to industry. But they were attracted by exoticism and worked on a talking robot. Actually it is very interesting. But as of today production needs an ordinary universal robot-manipulator, but one that is reliable. Alas, there is none!



Line for automatic thermal processing of sheets of springs with high-frequency currents.

To what extent is the problem of automation of production and introduction of labor-saving technologies at ZIL related to robot technology? The association has 345 automated and 798 flowline-mechanized lines, on which about 90 percent of the parts of automotive equipment are manufactured. In smelting production the level of mechanization and automation is 98.6 percent, forging--96.7 percent and welding--96.1 percent.

During the 10th Five-Year Plan the number of comprehensively mechanized shops increased. They included a newly created assembly shop with an area of 117,000 square meters, where transportation and assembly operations are comprehensively mechanized. It is joined to the processing shops by a widely developed system of suspended push-type conveyors with programmed control, and to the system of warehouses, covering a total distance of more than 26 kilometers.

All the large and heavy aggregates, engines, rear and front axles, cabs and bodies are delivered with this automated transport system to the assembly building. With the help of a computer, an aggregate of the necessary modification is automatically sent to the conveyor for general assembly of the motor vehicle. During recent years large comprehensive systems of automated lines have been introduced for complete processing and assembly of such heavy parts as drums and hubs.

Extremely large automated systems have been created for producing pistons and cylinder cases. They make extensive use of modern means of measurement and automatic adjustment of the instrument during the course of processing the surfaces.

Yet a considerable part of the technological and transportation operations are still done with the participation of a worker. As a rule, these are physically difficult operations, and under conditions of mass production they are monotonous and boring.

Even on automated lines the installation and removal of parts are frequently done by hand. Existing methods of automation do not make it possible to replace man in what would seem to be the simplest operations, or else this replacement involves very large expenditures.

Quite new possibilities of comprehensive mechanization of industrial processes are created by the application of automatic manipulators--industrial robots.

Quite recently, about 10 years ago, people mainly considered it inexpedient to apply robot technology under the conditions of mass production, where one and the same product has been produced for a long time and the tempo of the production cycle is not rapid. Actually, as a rule, in industries of this type they always try to manufacture one part on one piece of equipment, without readjusting it. The tempo of the production of a number of parts is within the range of 1-5 seconds. For example, hot stamping on presses with a tempo of a second: The part requires a close connection of a number of machines for feeding, cutting, forming and stamping the parts. Naturally, robots cannot replace such a highly productive stamping line.

Still, as the experience of firms in Japan, the United States, the FRG, Italy and also our own experience shows, under the conditions of mass and large-series production, industrial robots can be effectively used for comprehensive automation of physically difficult operations in smelting, forging, heating, welding, painting and other productions that have difficult working conditions, and also for creating automated lines, especially if the parts manufactured on the lines need to be changed relatively frequently.

Of course, the introduction of robots requires special technological preparation. The fact is that the robot-manipulators that are produced abroad and in our country, although they replace man in many operations, still have very limited possibilities. Thus a robot can pick up a part only if it is always fixed in a strictly determined position. A manipulator cannot perform such an apparently simple operation as removing the billets from the packaging or removing a part from a moving conveyor. The range of movement of a robot's hand is extremely limited, as is the speed of rotation on each axis in space.

This is why the introduction of industrial robots, especially under conditions of existing production, requires serious technological restructuring: the creation of orienting devices or accumulators that make it possible for the robot always to put parts in the same position; the development of a design for grasps that provide for reliable placement of the parts; and the development of a system of control for transportation, machines and machine tools which the robots serve.

Our association has created a central technological laboratory for robots which includes:

a technological bureau which develops processes of production using industrial robots in conjunction with technical services of plants of the association, and facilities and shops of the head plant;

a design bureau which creates experimental models of grasps, accumulators and orienting devices;

a control systems group which is designing a principally new schema for control of the entire robot complex.

There are 29 industrial robot-manipulators operating in the plant. What has the initial experience in operating them shown? Above all, we have become convinced that it is more economical to create sections and complexes using groups of robots. This way we achieve maximum release of the workers. Under the 11th Five-Year Plan we intend to create automated complexes of robot equipment in the smelting, forging, heating, welding, painting, press and mechanical assembly production. There will be 210-220 industrial robots working, and more than 300 people will be relieved of the most physically difficult operations.

Unfortunately, the reliability of robots is still inadequate and the volume of their memories is very limited. The best of the domestic robots is the Universal-15. But its limited memory only allows it to make 16 movements. And what are 16 movements? To go forward, turn, and place a part--three movements have already been used. And the robot has still not manipulated any part of the technology.

In conjunction with the automation faculty of our plant training center, we are working on "expanding the education" of the Universal-15--equipping it with an adaptive system.

During the process of automatic welding the fuel tank is placed on the line for controlling welding. It must be placed in a cassette which is continuously moving. The task requires that the robot be "conscious." Additionally, the automation laboratory has developed a system of orientation whereby the robot, "having seen" the suspension arm of the conveyor, immediately "makes a decision" and places a part on this suspension arm. This opens up great possibilities of utilizing robot equipment. For under conditions of mass production parts are usually transported by conveyor. Robots that are equipped with a system of orientation will be able to occupy a position on the conveyor.

An episode in the creation of an automated line for welding cabs using robot technology is interesting. For some reason a Japanese delegation was at the plant. Having seen this line the Japanese specialists were interested in the method of welding and asked to purchase our "know-how" regarding this. We, in turn, purchased from them several robots for the line. The joint protocol for the receipt of the automated line for welding cabs using industrial robots from the Kawasaki Yunimeyt firm says:

"The method of welding the ZIL acquired by the Kawasaki firm as 'know-how' has fully justified itself, and has resulted in the achievement of high quality of welding, precision and correct distribution of welded points on the cab."

The decree of the CPSU Central Committee and the USSR Council of Ministers concerning the development of robot equipment earmarked 22 ministries which are to make robots for themselves. In the first stage, until the Ministry of the Machine Tool and Tool Building Industry, the head branch for this problem, has adequate production capacities, it is apparently impossible to avoid such a decision. But the branches should still be given a developed design for the manipulators. I think that the principles of direct cooperation between science and production in the area of the introduction of laser technology, welding and other advanced technologies should be used in the development of robot equipment as well.

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## PROBLEMS OF INTRODUCING NEW TECHNOLOGY CONTRASTED WITH ZIL'S SUCCESS

Novosibirsk EKONOMIKA I ORGANIZATSIYA PROMYSHLENNOGO PROIZVODSTVA in Russian  
No 10, Oct 82 (signed to press 26 August 1982) pp 50-59

Interview with Aleksandr Ivanovich Buzhinskiy, deputy general director for economics, candidate of economic sciences, winner of USSR State Prize, by L. Leonidova: "The Actual and Calculated Effect"

Text Aleksandr Ivanovich Buzhinskiy, deputy general director for economics, candidate of economic sciences and winner of the USSR State Prize responds to EKO's questions.

Question The problem of the influence of new technical equipment on the economic indicators is extremely crucial for many enterprises. Plants and associations frequently hold up the introduction of new technical equipment because they say it worsens the results of production and economic activity. And it happens that the technical services of the enterprise account for "conventional" economic effect from innovations and receive bonuses while the production experiences no actual advantage from this. Tell us about the degree to which ZIL has managed to overcome these difficulties and contradictions?

Answer Economic effect and actual usefulness . . . it would seem that there should be no contradiction between these concepts. Everything that produces an actual, appreciable advantage should be advantageous. But nonetheless this is not always the case. The fact that economic situations arise wherein, because of the imperfect economic mechanism, it is disadvantageous for enterprises to force scientific and technical progress was discussed at the November (1981) Plenum of the CPSU Central Committee by Leonid Il'ich Brezhnev. Unfortunately, many of these situations arise. I should like to begin my answer with some aspects that machine building industries have in common which are reflected in the introduction of new technical equipment.

In the first place, we experience the inadequate capabilities of branches that affect machine building, especially the machine tool building industry. Whether it is advantageous or disadvantageous, the plants and associations must create their own equipment production. You may say: "What is special about this? Many foreign firms do this." But they do it on a different basis! They purchase prepared parts and aggregates and assemble machine tools. Unfortunately, we do not have specialized enterprises which can satisfy the demand for such units.

Taking into account the fact that there is a lot that we cannot obtain, ZIL created its own production base for manufacturing equipment. If one goes through our shops one can see how many machines and mechanisms we have made for ourselves. We have our own press production. We are even selling abroad unique presses with a power of 3,500 tons. We are creating conveyors of the push type with automated dispatch of cargos and we are making our own production packaging. Just as a result of the standardized multiple use containers we have reached a point where 96 percent of the transportation work at ZIL is mechanized. Unfortunately, many tens of thousands of units of containers have remained on the railroad and at related enterprises which have not returned them even after our reminders. We have about 350 automated lines in operation. Of these, 110 were designed and manufactured at the plant. We make welding equipment, sets of machine tools and even sets of thermal equipment. And I am not even speaking about instruments, stamps and fittings. Not all of this is economically advantageous, but it is all necessary for production. Many of these parts could be much less expensive if they were manufactured at specialized plants of interbranch industries. But there are very few such enterprises, their list of products is small and therefore the plants and associations have to develop a "physical economy" and create everything for themselves.

In the second place, there are serious shortcomings in planning and economic stimulation of scientific and technical progress. First of all, a general problem which pertains not only to machine building, but also to other branches --improvement of the system for calculating the economic effect from new technical equipment. If one is oriented only toward the effects obtained in keeping with existing methods, one can simply stop progress . . . it does not take into account many factors, including social and ecological ones. Let us take this example. We have created an automated line for stamping, welding and assembling gasoline tanks that is equipped with robot technology. We have released 16 workers. But if one calculates this according to existing methods, it produces no effect: We use costly presses that we have purchased for stamping parts of the tank, and the robot-manipulators are not advantageous. But it is clear that when determining the economic effect from robot technology, in addition to the savings on the wage fund from the released workers, it is necessary to take into account other factors. By eliminating working positions we reduce expenditures on training, housing, public health and other expenditures from the consumption fund, not to mention the fact that we are removing people from technological processes that involve difficult and harmful working conditions.

When calculating the effectiveness of new technical equipment we do not take into account the fact that production capital becomes more costly. Recently manufacturing enterprises have been increasing prices for equipment by fair means and foul. After the reconstruction at ZIL the value of the production capital increased sharply. And the output-capital ratio apparently declined. But the prices of the new equipment installed after the reconstruction and those of the old equipment are incomensurable. Moreover, the products that are being manufactured now are more efficient. Can one really compare the ZIL trucks of the 1930's and the 1980's!

And another important point. It is impossible to reduce everything to the same level. Financing and stimulation of science and technology should take into account the specific features of the branches and the enterprises. A unified fund has now been created for the development of science and technology (YeFRNT). The methods for its utilization stipulate that the result of the introduction of measures of scientific and technical progress should be reflected in the balance of the enterprise. In mass production it takes 6-8 years from the creation of the basic model to the introduction--the delivery of the item to the conveyor. A motor vehicle must be tested in all ways before beginning mass production of it, and it is necessary to reconstruct existing capacities, to assemble new sections and automated lines and, possibly, to construct new industrial buildings and so forth. The same thing is true in agricultural and tractor machine building. The amount of time is so significant that the role of the bonus for the introduction of new technical equipment decreases. People can be replaced during this period. And it turns out that some of them have developed the new technology while others receive the bonus.

Thus, apparently, the YeFRNT which was extremely effective in the electrical equipment industry, where an economic experiment for stimulating scientific and technical progress was conducted, cannot be introduced without changes in branches of machine building with mass flowline production. We have started to apply the YeFRNT according to the proposed methods and we are experiencing serious difficulties in stimulating the production of new technical equipment.

Question Nonetheless, the majority of enterprises are improving the organizational and technical level of production and updating the products, including ZIL. What gives rise to this?

Answer With all the difficulties and unsolved problems, why is new technical equipment introduced? In the first place, planning requirements must be met. Without technical progress it becomes impossible to fulfill the plan. It is necessary to assimilate new items, increase labor productivity and provide the necessary growth rates of production. In the second place, there is the understanding of national economic interests, professional and engineering pride, and the prestige of the enterprise. During the past 15-20 years the rates of work on new technical equipment have increased at ZIL. A system has been created for cooperating with science and we have developed our own methods of calculating the economic effectiveness of new technical equipment which will make it possible to actually reflect the results of the innovations.

Question Aleksandr Ivanovich, please discuss in more detail your methods of calculating the economic effectiveness and the organization of the accounting for the economic results that are achieved.

Answer We have improved the existing methods, taking into account the peculiarities of our production. We have developed a "Methodological Aid for Determining the Economic Effectiveness of New Technical Equipment, Inventions and Efficiency Proposals at the ZIL Production Association." Our methods have the goal of eliminating contradictions between the calculated economic effectiveness and the actual usefulness of the measures. It is based on the principle of obtaining not a conventional, but a guaranteed effect. The methods also envision calculating the constituent parts of the social effect.

The first stage is the calculation of the relative economic effectiveness of the technical equipment in the stage of research directed toward selecting the optimal variant of the decision and determining the expediency of one development or another.

The second stage is the calculation of the guaranteed economic effect in order to decide whether to include or not to include a measure in the plan. Thus those projects which promise a real advantage to production are taken from the plans for cooperation with scientific organizations and included in the five-year comprehensive plan for scientific and technical progress. It is probably because of this and also because of the fact that our agreements for cooperation envision bringing the scientific idea up to the point of introduction into production that we, unlike many other enterprises, have no complaints against science. There are no projects that are abandoned along the way. They are all brought to the final result. Of course, we also have failures. But a failure revealed in the process of research cannot be the basis for complaints against those who advanced the ideas.

And so a project is included in the plan. Subsequently the reality of the economic effect is verified by calculations in all stages of scientific research work, experimental design development and technological preparation for the production of the new item. And, finally, a final calculation is made of the economic effect of the new technical equipment in order to determine additional deductions into the association's material incentive fund.

All changes in the design and technological plan, if they lead to changes in production outlays, should be accompanied by calculations which are signed by the deputy director for economics. The association has created a bureau for investigating the effectiveness of measures for technical development. It is structurally a part of the division for preparation for production, but it is under the jurisdiction of the deputy director for economics. The bureau is recognized by all services. Its decisions carry a lot of weight in evaluating the economic effectiveness of new technical equipment.

A special group has been created in the head designer's division for technical and economic justification of the design of the motor vehicle. Methodologically, it is under the jurisdiction of the association's deputy director for economics. All technical and economic calculations concerning new technical equipment are concentrated in the hands of the association's economic leaders.

Question Does it not happen that, because of the lack of an economic effect, you reject a measure which is nonetheless necessary for production?

Answer I long ago abandoned the "sweet dream" of rejecting innovations that do not produce a calculated economic effect. Everything is much more complicated than this.

Let us take, for example, the production of parts by the method of pressing from powder. If one approaches this from the position of the immediate effect, the economist must forbid the introduction of this technology since the parts are very expensive. But the high cost of metallic powder, it seems to us, is a temporary thing. As the possibilities of powder metallurgy expand, the

prices should drop. Even the fact that 70 workers and 50 machine tools are released when 1,000 tons of parts are manufactured from powder rather than by the traditional methods shows that this is a promising project. Moreover, an immense amount of metal will be saved. Consequently, it is necessary to assimilate new technology and be prepared for its mass introduction.

Finally, we are always continuing to work on improving the methods of economic calculations, on which the determination of the actual effect also largely depends. We are striving to reach a point where the methods are accessible and comprehensible to everyone who is involved with new technical equipment, efficiency proposals and inventions, so that there will be a single system of calculations at all 16 enterprises of the association. We try to provide concrete examples for each kind of calculation and each particular case. The efficiency expert, the inventor and any technological engineer or designer participates in the development of innovations, using examples of calculation, and he himself can make a preliminary calculation of the effectiveness of his proposal.

Question If serious financial, material and organizational difficulties arise with the introduction of new developments even at ZIL, how is it with smaller associations and smaller and medium-sized enterprises? How can principally new technology and new means of mechanization and automation of production come to them? What assistance can be rendered to these industries by the leading enterprises of their branches?

Answer Proliferating innovations and transferring them to related and similar enterprises constitute a serious problem which deserves the most constant attention. It is necessary to create an economic and organizational situation wherein it is advantageous for the pioneer enterprises in the development of new technology to transfer their achievements to others. It is also necessary to have good coordination of the introduction of large technical and technological innovations on the level of the national economy.

There are instructions concerning the encouragement of the transfer of scientific and technical information to other enterprises. But that is all. And yet someone must reproduce this information and technical documentation--it requires people, reproduction equipment and materials. It is even more complicated to help in manufacturing installations, stamp and other devices. Apparently, if an enterprise is assigned the role of being the head enterprise in the industrial assimilation of principally new technology, it should have the appropriate resources, rights and responsibilities.

This does not mean that ZIL refuses those who come to us with problems about new technologies. Our specialists give advice and consultation and offer the opportunity to become familiar with the work of the laboratories, installations and production.

But you will agree that the enterprise to which one turns for technical assistance has a lot of additional bother and . . . nothing else. The prestige is nice at first. But when the number of organizations that want assistance is so great that it is impossible to respond to all the requests, prestige is no longer very important!

Assistance and services in reproducing and introducing developments--"software" should be well paid for. It is necessary to be compensated for all expenditures involved in this work.

Or take the introduction of inventions and discoveries. It would seem quite clear that the State Committee for Inventions and Discoveries should help in the introduction. But it does not deal with this at all. Many brilliant ideas go for many years without reaching production. This is inexcusable wastefulness and inefficient attitude toward creative potential.

Question When discussing the economic mechanism for control of scientific and technical progress at ZIL you have discussed the association as a whole. But ZIL is one of the largest production complexes. Its enterprises are located in various regions of the country. To what extent does the system for accelerating scientific and technical progress take into account the needs of the branches.

Answer We have, as it were, the cart before the horse. More attention is being devoted to the branches. But before discussing this in more detail we should make a little clarification with respect to the association's organizational structure. All 16 plants that are included in it are production units, whether it be the Moscow Plant for Cardan shafts or the Chita automotive assembly plant. They do not have their own balance or autonomous financing. The association keeps account with the budget centrally. The gross and commodity output does not include the association's internal commodity turnover. If it did it would be immense. There are no repeated accounts. The branches are specialized. Each of them has become an organic part of the industry. Consequently, problems of the technical level of each of them are problems of ZIL as a whole. This is why we devote somewhat more attention to re-equipping our branches. For many of them were considerably below the technical level of the head plant when they entered the association. Now the picture has changed sharply. As for several of the newly created enterprises, they have considerably surpassed analogous industries of the head plant in terms of technical equipment. This is quite understandable: ZIL is already 50 years old. The need for reconstruction has not always been met with production and financial capabilities. For example, the Mtsensk plant for aluminium smelting is incomparably better equipped than the smelting production of the plant imeni I. A. Likhachev.

The comprehensive plans for cooperation with science also confirm the increased re-equipment of the branches. The first laser installation went to the Moscow plant for Cardan shafts. The Skopin plant for sets of equipment was the first in the association to receive technology for submerged electric arc remelting, which was developed by the Institute of Electric Welding imeni Ye. O. Paton and makes it possible to obtain high-quality steel for vital parts. The Yartsevo cast iron plant is being constructed on a high technical level using reduced-waste technology.

I think that certification and registration of working positions contributes to the effectiveness of mechanization and automation of production at the enterprises. During the process of this work one discovers primarily whether one working position or another meets the requirements for loading of equipment,

safety and working conditions. Registration makes it possible to reveal specific problems in each working position. It will become the main instrument for justifying the planning of the number of industrial production personnel. The labor plan will be concrete and calculated. This work is being done preliminarily as an experiment in two shops of the head plant which, in our opinion, have not turned out well with respect to the utilization of equipment, working conditions and labor turnover. In one of them we discovered 10 superfluous working positions which could be eliminated or combined with others. To do this it was necessary, in addition to taking measures for mechanization and automation of production, to carry out a certain amount of reorganization of the sections and replanning of the equipment. In another working position there was surplus equipment.

Question In conclusion, a couple of words about the results of the functioning of the system for accelerated introduction of new technical equipment.

Answer The results of the 10th Five-Year Plan show that we have chosen the correct direction for strengthening the alliance between science and practice. In 1976-1980 the country's national economy received more than a million trucks and 667,000 household refrigerators, including more than 7,500 trucks in excess of the plan. Labor productivity increased by 30.9 percent, which is considerably greater than the average branch rates. At the same time we saved 285.9 million kilowatt-hours of electric energy, 36,700 tons of conventional fuel, and more than 50,000 tons of rolled metal.

Our association delivers trucks to 50 countries of the world and household refrigerators to 60 countries.

Under the 11th Five-Year Plan we will have the same high rates of growth of production volume and labor productivity, the assimilation of principally new designs of motor vehicles, increased output of vehicles that operate on diesel fuel, and large-cargo trucks. The improvement in scientific and technical developments earmarked for this five-year period will help us to carry out the tasks that have been set.

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## ZIL'S MANAGERS, SCIENTISTS LAUDED FOR R&D REALISM

Novosibirsk EKONOMIKA I ORGANIZATSIYA PROMYSHLENNOGO PROIZVODSTVA in Russian  
No 10, Oct 82 (signed to press 26 August 1982) pp 60-69

Article by Ye. Lysaya: "A Day of Results"

Text Man has inhabited the heavens.. The word "space shuttle" is sounding more and more ordinary, almost like bus. Darting helicopter birds hanging over a construction site with cargos in their beaks are successfully competing with ground cranes which, for example, cannot deal with the lack of roads in the north or the sands of the desert.

Man is rushing toward space. Transport spaceships are putting cargo and fuel into orbit. We still speak of this with excitement, but soon we will be accustomed to space transportation just as we are to space shuttles and crane helicopters, as we have become accustomed to all the innovations with which the scientific and technical revolution has endowed our century.

But still man cannot do without ground transportation, either now or in the foreseeable future. The automotive era continues! And in order for the motor vehicle to be manufactured economically and with a minimum need for working hands, in order for the air not to be polluted by exhaust fumes, in order for it not to eat liquid fuel so greedily, its creators will have to solve many problems. This is why they are so persistently calling for help from science.

The summary report of academician Viktor Alekseyevich Yefimov is extremely short: 21 joint projects for cooperation, 18 of which can be transferred to the plan for introduction and 3 of which are still research subjects. A very laconic description of the state of each project and important problems . . . .

February, 1982. A conference of specialists from ZIL and scientists of the Ukrainian SSR Academy of Sciences devoted to the results of joint scientific research work in 1981 is in progress. It is led by two co-chairmen: the head curator of the comprehensive program for joint scientific research work of the republic academy and ZIL, the vice-president of the academy, and the director of the institute for problems of smelting, academician of the Ukrainian SSR Academy of Sciences, V. A. Yefimov, and deputy head engineer of ZIL for new technical equipment, S. V. Gorokhin.

Since there is no need for repetition, Sergey Vasil'yevich limits himself to a brief remark:

"While in the summer of 1981 at our meeting in Kiev there were debates about the time period and problems related to carrying out certain research projects, now we can discuss the fact that the absolute majority of them have been realized. The question of a scientific stockpile for the future has arisen. The rates of introduction were determined by the rates of research. Is this good or bad? So far it is good because we have succeeded in accelerating the process of the realization of ideas which has always been a stumbling block. Now we need a reserve of research projects. We and the specialists are thinking of our orders and awaiting your innovative suggestions."

The alliance with science has perhaps been even more important for ZIL workers than for other automotive plants. Few of our contemporaries will recall the AMO plant and its 1.5 ton weight trucks with which Soviet automotive construction began in 1924. During the years of the 1st Five-Year Plan the AMO facilities were replaced by a completely reconstructed automotive plant. But it is now already 50 years old. Next to the young VAZ and KamAZ, the ZIL would not feel so confident if during all the years, in conjunction with science, it had not engaged in improving technology and equipment.

The production complex created on the basis of the Moscow Automotive Plant imeni I. S. Likhachev is one of the largest in the country. There is no other association that has so many thousands of kilometers between the extreme points of distribution of its industries (for ZIL these points are Zhitomir and Chita). In order to reduce to a common denominator the 16 plants that are very different in terms of their technical and technological level, it was also necessary to turn to science for help.

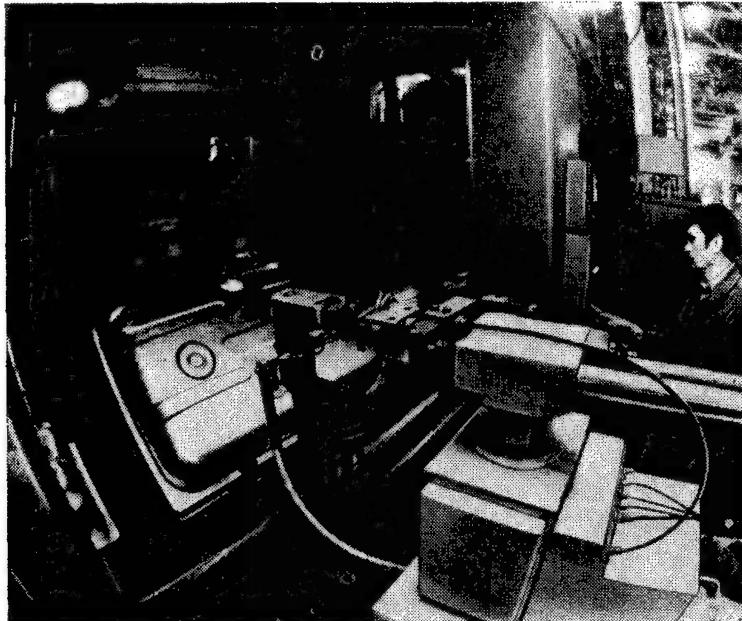
In the technical divisions, which are located in the 12-story administrative and laboratory building, rising over the massive production buildings like a thin candle, in the engineering building and the experimental sections as well as in the plant shops on any day one can find scientists from Kiev or Lvov, Leningrad and, of course, Moscow . . . .

But there are also days like these when the scientists and specialists gather in the meeting hall of the council of directors on the 12th floor of the administrative building to sum up the results of the preceding year and establish programs for the next year. On these days, which are called days of results at ZIL, one can see the broad panorama of cooperation.

ZIL workers avoid large showy conferences with science, preferring purely working meetings with discussions of each program for scientific research work individually.

A correspondent can consider himself very lucky to be at ZIL at a time when the association specialists are meeting with scientists of the Ukraine, if only because the institutes of the republic are conducting a large number of projects under the plan for cooperation between ZIL and the USSR Academy of Sciences, and the alliance between ZIL and them is extremely solid.

During the first years after the war when they were still discussing the extensive dissemination of welding processes in machine building, the Institute of Electric Welding imeni Ye. O. Paton of the Ukrainian academy saw that the Moscow automotive plant was ready to begin the introduction of new technological processes. From that time until now all new welding technologies developed by the institute which could be applied in automotive construction have made their debut at ZIL.



Automated line for welding gasoline tank.

But already, along with the Institute of Electric Welding, institutes for super hard materials and material science, problems of smelting, physics and mechanics, metal science and chemistry of high molecular compounds occupy an important place in the program for scientific and technical cooperation between the ZIL association and the Ukrainian Academy of Sciences. Many of them were enlisted for cooperation by the director of the Institute of Electric Welding, academician Boris Yevgen'yevich Paton, when he became president of the the Ukrainian SSR Academy of Sciences.

Like the main speech, the subsequent remarks were short as well. Only with brief and clear information, a summary and proposals can one stay within that small time limit which has been established for both sides for the final conference, for it is necessary to hear the representatives of all institutes participating in the cooperation and also the ZIL engineering services. The preceding day and a half, with mutual agreement, was devoted to work in the shops and scientific and technical subdivisions. Here they considered thoroughly and comprehensively each detail of the project and crystalized the "dry substance" which makes it possible to compress a large idea into the few words of communication that are allowed.

In the general report concerning the Institute of Electric Welding there were only a couple of words, including these: "We have approved a model of an automated control system for technological processes (ASUTP) with a microelement base of the Elektronika-60 system." The co-speaker, the head welder of ZIL, candidate of technical sciences Mikhail Mironovich Fishkis added one phrase which could seem incomprehensible to the uninitiated: "The Podola team will soon know welding at ZIL better than I do."

Two hours before the summary conference in the office of Mikhail Mironovich, I had occasion to meet members of the Podola team. The senior scientific worker, Valeriy Semenovich Gavrish, was already there. A division chief of the Institute of Electrical Welding, candidate of technical sciences Nikolay Vasil'yevich Podola appeared within 10 minutes. When I came in he was talking on the telephone since those who had gathered in Fishkis's office wanted to discuss and clarify something once again before the main meeting.

In the section for welding the fuel tank they said that Podola had gone to the cab shop. "Yes, he showed up," they confirmed, "but now he is on his way to your division."

"He is inspecting the welding line," smiled Mikhail Mironovich.

And this was really a careful, even a biased inspection because the ASUTP on the microelement base will operate effectively only with high-quality technological equipment.

"With condensor welding it is useless to operate the system. The condensors are not reliable. The system will only warn of breakdowns and establish them," announced Podola who had appeared in the office.

"What do you suggest?" asked Fishkis.

"The same thing as Gavrish: the changeover to contact welding and to order new machines from the Pskov plant for heavy welding equipment."

The head welder and the deputy chief of the press production began to think. Gavrish actually had made this suggestion to them. He had spent almost a year and a half continuously with a group of engineers at ZIL, dealing with the installation and testing of a model of a system with a microelement base. He went to Kiev only for business trips or to discuss urgent problems.

The production workers have no objections. But so far they do not have information that with such technology contact welding with alternating current will produce a 100-percent guarantee of the durability and the quality of the seam. And with welding with direct current and condensor batteries they have this guarantee, although the batteries themselves frequently malfunction and have to be replaced. They have reconciled themselves to this because the sealing of the seam is the alpha and omega of the very existence of the fully welded fuel tank of the motor vehicle. So far they have not given up soldering anywhere in the world. At ZIL too the mouth of the tank has been soldered because that was the only way they managed to make sure it was sealed. And soldering is a

manual task which means a large expenditure of tin alloys which are in short supply. The shop was very dependent on the worker who did the soldering. If he did not show up for work the entire line had to stand idle.



The experimental installation for powder metallurgy not only develops new technologies for the manufacture of parts, but also fully provides production with individual parts. In the photograph: bearings being pressed.

With the help of the Institute of Electric Welding imeni Ye. O. Paton, they managed to develop technology for manufacturing a completely welded tank. Incidentally, not using tin alloys produced a savings of 500,000 rubles a year. Now the shop manages in two shifts to provide the plant with gasoline tanks for the entire production program for the output of motor vehicles. They have eliminated night shifts and manual soldering, and at the same time they replaced manual loading with automated loading, using robot-manipulators, and released 60 people. The ASUTP should complete the process of automation and provide for full control of the technological process. Then the new generation of ASUTP will be extended to other welding lines.



In the spectral analysis laboratory.

There will still be discussions of the "pros" and "cons" of contact and condenser welding and there will still be many difficult conversations with the Ministry of Instrument Making, Automation Equipment and Control Systems, which does not provide the necessary monitors and deprives the ASUTP of the possibilities of controlling a number of technological conditions. But the final phrase of the head welder of ZIL in the meeting hall of the council of directors seemed to sum up the result: The work of the "Podola team" is satisfactory, the model of the ASUTP has been approved, and science is leading technology forward.

"As a result of the introduction at the Simferopol plant of modern industrial methods of capital repair, to provide for doubling the service life of the engine of a ZIL-130 motor vehicle after repair, increasing it to 0.8 of the service life of a new engine" . . . these lines from the socialist commitments of the association which were approved by the CPSU Central Committee are the best illustration for the information of the main report to the effect that new technology has been approved for toting during the refurbishing of crankshafts, filler wire have been created, and optimal conditions for refurbishing cylinder blocks and methods of prerepair diagnosis have been developed.

Incidentally, at the conference which we are discussing all this information concerning the completed developments on a high national economic level did not draw the attention that one unsuccessful did. And this also shows the business-like style of the cooperation: the discussion was only about that which requires a solution.

"Research on the coating of pistons did not produce a result and the project was excluded from the plan for introduction," noted the main speaker. "No, the project did not turn out," confirmed the chairman of the Institute of Electric Welding, Nikolay Vasil'yevich Podola. "But in no case can we put this work to the side," Fishkis became excited. "On the contrary, both sides must

step up control over the course of the research. I think that the failure was caused more by the lack of conscientiousness of the workers than anything else." "We shall carry out this project more intensively," promises Podola.

In the alliance between scientists and ZIL there is a kind of scale of values: the plan for introduction should include only those projects which promise a real result.

"The psychological climate of mutual understanding did not appear immediately," says the deputy director of ZIL for economics, candidate of economic sciences, Aleksandr Ivanovich Buzhinskiy. "We have learned to be patient and we have learned to wait. Scientific research is to a considerable degree searching. Some things can be achieved and some things cannot. The psychological peculiarity of production workers is to demand 'hurry up, hurry up.' And it is difficult to blame them for this: they are dominated by the plan. And ZIL workers are no exception. But science can be put off by this approach since in research haste gives rise to failure and incorrect decisions. In turn, our partners have gained a sense of our responsibility for the fate of production. Each year there are fewer and fewer unfinished developments."

Aleksandr Ivanovich noted the psychological basis of the alliance, but it has become this way largely because of the efficient mechanism for controlling developments: At ZIL the work is considered completed only when it has reached the stage of industrial introduction; one plans not the conventional, but the guaranteed effect and the actual effect is made more precise in all stages of the project.

In previous five-year plans expenditures on scientific research and experimental design work in the association exceeded the economic effect from the new technical equipment. Under the 10th Five-Year Plan when this mechanism for controlling developments was put into effect, the economic effect from new technical equipment and scientific research work surpassed expenditures 3-fold.

Only when the deputy head metallurgist for smelting, candidate of technical sciences Georgiy Vasil'yevich Prosyanyik at the Day of Results declared the work for electromagnetic doser to be successful, only after this did candidate of technical sciences from the Institute of Problems of Smelting, Viktor Ivanovich Dubodelov respond:

"It is good that you have accepted the doser. I think that now it is possible to request financing for manufacturing them. Also remember our desire to improve the operation of the doser. Incorrect utilization can have a bad effect on the innovation."

"I accept the remark and support the proposal for financing," responded Prosyanyik.

"If exhibits were distributed at industrial equipment fairs according to their significance and importance, the dosers would occupy a respected position, for they are the beginning of almost any technological process"--this was written in one of the last issues of the magazine ZNANIYE--SILA. The article

discussed new electric dosers for bulk substances. But dosers are no less important in metallurgy where they not only provide for precision of the formula, but also replace man in the high temperature zones.

Previously in the association metal was fed into the installation for aluminium smelting with buckets. Now it uses electromagnetic dosers that were created by the Institute of Problems of Smelting. The quality and precision of the forged pieces have improved. With operation on two shifts each doser has released 2 people. About 20 dosers have already been installed. An even greater effect is produced by automating dosing for large castings.

The leader of the group of the Institute of Material Science, Leonid Naumovich Beloborodov says:

"We have worked under an agreement for creative cooperation. And I think the results of the research are convincing: the project is promising. One can include in the plan for introduction the manufacture of a hydraulic booster stator made of metallic powder."

"I am for this," the head metallurgist of the forging and thermal industries, Veniamin Davydovich Kal'ner, enters the conversation. "True, parts made of powder are not yet profitable. But we are like experimental rabbits who turn out to be useful outside of our cages: if we develop the technology it will be easier for others to introduce it."

The scope of research and experiments in the area of powder metallurgy at ZIL is so significant that it would do credit to any specialized scientific research institute. An experimental section has been organized which could be called a production section since it fully provides the association with certain parts made of powder. Here the technology developed in cooperation with Ukrainian scientists is tested. They create and test equipment and fittings which are then even transferred to enterprises that supply parts made of metallic powder, including . . . the Moscow and Brovary powder metallurgy plants. ZIL and its scientific and technical center, the marvelously equipped laboratories and experimental production, and the highly competent specialists are capable even of this kind of activity. But the satisfaction is mixed with a certain feeling of vexation: Why should the principles of natural economy pervade even the organization of the output of new materials? Why must the client be more concerned about this than about specialized enterprises?

The technology of powder metallurgy is more expensive for ZIL because it has to take responsibility for everything--from setting up the experiment to manufacturing presses for hot stamping of thermal parts or furnaces for thermal chemical processing of parts.

The day of results was more of a day of prospects. Everyone tried to share his thoughts, clear up doubts, and discuss plans for the future.

"Perhaps we are not hurrying with the results, but our enthusiasm has been cooled to some degree by designers who have said that the time for the adhesive welded motor vehicle has not yet come. Still we can discuss the

industrial output of adhesives for adhesive joints instead of welded ones under the 12th Five-Year Plan," candidate of chemical sciences, scientific worker of the Institute of Chemistry of High Molecular Compounds, Anatoliy Nikitovich Kuksin, discusses his problems.

"The subject is so important and promising that I suggest that we do not put it off until the next five-year plan. Adhesive compounds should help us in solving problems of corrosion resistance and durability of the body of the motor vehicle," says Kal'ner.

"Recently in this hall we met with the Mosavtotrans," responded Fishkis, "and came to the conclusion that today one of the weakest places in the cargo truck is corrosion of the cab. Therefore we ask you to accelerate this work. I suggest that we should try to introduce the project by the end of the 11th Five-Year Plan."

The Lvov physics and mechanics institute, having carried out a number of interesting projects, refuses to create automated means of control because the savings are not calculated. The head metallurgist insists: "In our thermal production the control functions are now performed by many people, and the results of the control are not sufficiently trustworthy or reliable. If our automatic control instruments make it possible to eliminate these negative consequences, after a certain amount of time the effect will manifest itself, and then we will calculate it."

"And if it is necessary for production, the project will be carried out," academician Yefimov concludes the discussion, "But the plant workers must understand us. The institute cannot conduct scientific research for which the economic effect is not calculated. Nonetheless, at the end of the year a commission will come and demand information about the economic effect . . . ."

Concern for better utilization of developments and the scientific reserve, and discussion of the new plan for introduction and problems of economic effect--all show that joint scientific research is continuing and that both partners are thinking about the future of cooperation.

In conclusion, one more fact. For radical improvement of production technology on the basis of accelerated introduction of the latest achievements of science and technology, the group of managers and specialists from ZIL and scientists were awarded the USSR State Prize in 1981.

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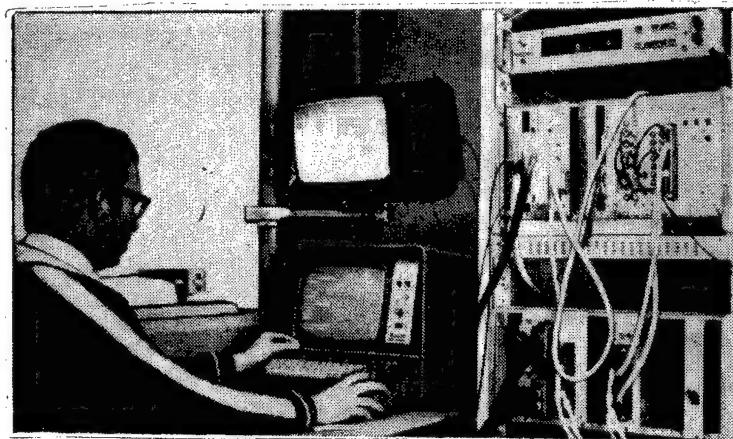
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## POTENTIAL FOR, OBSTACLES TO, WIDER COMPUTER USE EXPLORED

Novosibirsk EKONOMIKA I ORGANIZATSIYA PROMYSHLENNOGO PROIZVODSTVA in Russian  
No 10, Oct 82 (signed to press 26 August 1982) pp 71-96

Article by Ye. Ye. Nesterikhin, academician, director of the Institute of Automation and Electrometry of the Siberian Branch of the USSR Academy of Sciences (Novosibirsk): "Computer Equipment: Capabilities and Barriers"

Text The pages of magazines, newspapers, popular science books and specialized literature are filled with information about the new and broader possibilities that are opened up to man by electronic computer equipment (EVT). But as decades of assimilation of more and more improved kinds of computers pass, it becomes obvious that we are dealing with a phenomenon which has no analogue in the history of mankind. People have become accustomed to the fact that the machine is a mechanical device whose main task is to expand the energy capabilities of man and to replace his muscle power with energy obtained from the environment. Of course everyone knows that computers increase our intellect and not just our physical power. But from this knowledge to an understanding of the unusual situation that is forming before our eyes is an immense distance.



CAMAC equipment in scientific experiment: Investigation of the mechanism of the origin of turbulence.

So far the assimilation of computer equipment in our country's industry has been passing through the stage of familiarization with the possibilities of electronic computers. This is the only way we can evaluate the ASUP, ASU and ASUTP that are already existing and are being introduced, in which the electronic computer, as a rule, fulfills the role of a large, costly and not always reliable arithmometer. The stage of familiarization itself is necessary, but has it not gone on too long?

The period of effective and extensive inclusion of computer equipment in productive forces must finally come. The party and government are orienting us toward this.

In the next few years "there will be significant expansion of the production of miniature electronic control machines as a constituent part of basic technological equipment, instruments, various systems and means of administration and control."<sup>7</sup>

There is no longer any doubt that the main task of computer equipment is automation of the intellectual and production processes of the activity of the entire society. It is precisely here that it will produce the greatest effect and it is precisely here that one sees the multifaceted syndrome of our unreadiness for its active assimilation.

#### The Need for Psychological Restructuring

It is known that today any device included in computer equipment consists generally of two parts: hardware and software. It is also known that the proportions of program software is steadily increasing and is now fundamental in the value of electronic computer systems and expenditures on their creation. When electronic computers are manufactured in series at an industrial enterprise, expenditures on the development of complex systemic mathematical software exist only in the form of expenditures on copying instructions and program carriers: magnetic tapes or disks. The fact that standard mathematical software is delivered to the user practically free of charge is a reasonable measure and is not even noticed when the electronic computer functions as a large arithmometer. But as soon as the electronic computer is built into technological equipment, the situation changes radically. The fact is that the hardware and software are essentially unified. It is understandable that the greater the number of functions the software takes on, the "less expensive" the technological equipment controlled by the electronic computer becomes.

But let us think: Who needs this in the existing interrelations between the enterprise and the scientific research institute developers? This reduction in cost is not in the interests of either of the parties. When there is a possibility of reducing the cost of an ordinary industrial item by, for example, replacing certain materials with others, this lack of interest is surmounted, even though with difficulty. But the possibility that many specialists with soldering irons who are employed in production can be replaced by one programmer in the stage of development is so camouflaged that one does not even notice the

<sup>7</sup>"Materialy XXVI s"yezda KPSS" [Materials of the 26th CPSU Congress], Moscow, Politizdat, 1981, p 115.

lack of desire of the interacting parties to improve products and make them less expensive. It is not even clear whether or not it is easy to think of a plan mechanism which would contribute to rapid replacement of mechanical products with programs.

It seems to the author that this problem goes beyond the framework of the development of an effective economic mechanism. It generally goes beyond the framework of purely economic problematics and has important socio-psychological aspects.

In man's psychology, in his daily consciousness, one finds widespread the not quite correctly understood "Armenian" principle: If you command not with your mouth but with a division, you are a general! In other words, if you have control over concrete requirements for a volume of resources, you have the right to be considered a "general." There are no objections to this principle as long as it is applied to traditional resources. But when we are dealing with technical equipment which concentrates intellect, everything changes. Two talented programmers are equivalent to 2,000 mediocre ones, and an electronic computer with developed mathematical software is equivalent to thousands of electronic computers without programs. In this case who should be considered the "general"? So far we continue to think that the more important one is the one who has received the largest amount of money from the state. Calculations of nonexistent effectiveness are only superimposed on this psychological principle which everyone understands.

And suddenly--a quite different approach: It is necessary to understand that during the course of extensive assimilation of computer equipment an intellect, which belongs to the society as a whole and is remote from man becomes part of the economy. And we all know how difficult it is to evaluate the effectiveness of intellect in general, not to mention the level of this intellect.

As long as we value not so much the power of thought and not knowledge, but something we can take in our hands and hold, this psychological barrier will be an important obstacle on the path to extensive and effective utilization of computer equipment.

I shall give an example from a related area. In order to ensure precision of measurements, it is necessary to have standard measures of length. The initial standard for measures of length is presently a meter stick made of a special plantinum and iridium alloy which is kept deep underground, in the basements of the USSR Gosstandart. In order for this meter to have any relationship to a machine tool which processes a precision part in Novosibirsk, it is necessary to have thousands of people who initially take a copy from the standard meter and then make a copy from a copy and so forth. In each stage mistakes accumulate, so that one can no longer talk about high precision.

For 20 years our institute has been trying unsuccessfully to "force through" the introduction of a new standard of length which is widely used in the world and is the length of a wave beamed by a special laser that was developed in our country and is on the level of world standards. The length of the wave does not need to be copied, it is always the same--in Moscow, in Novosibirsk

or in any other place. The advantage, it would seem, is obvious. And when we speak of changing over to the new standard of length in academic circles, these suggestions are approved. But when the same suggestions are brought up to the Gosstandart, they elicit a spirited debate. Is this only because the length of the wave, unlike the standard meter, cannot be touched or seen with the naked eye? Of course not. If along with the increased precision of the new standard of lengths we were suggesting the corresponding increase in expenditures on the system of standardization which everyone can understand, one could forgive the objections to the apparent immateriality of the electromagnetic wave. But what is actually being suggested? To increase the precision of measurements in production and at the same time to reduce expenditures on copying and storing standard measures of length. The psychology of the narrow specialist rises resolutely against this, particularly if it is reinforced by departmental interests.

A quite analogous situation arises during the course of transforming computer equipment into a major element of productive forces. The overwhelming majority of managers still cannot recognize that a skillfully compiled program, which cannot be taken into one's hands, is equivalent to many tons of equipment and a large number of skilled workers. Here arises the psychological barrier which must be surmounted before we can learn to select truly effective directions in the development of computer equipment and its application.

#### Evaluating the Readiness of Science

Initially it might seem strange that even the sphere of science is not ready for extensive introduction of computer equipment everywhere. In order to clarify this idea I shall have to make a small digression.

In the modern stage of scientific and technical progress the idea of computer equipment as machines with large computing capacity which operate independently, without connections with other computers and without exchanging programs and information with them, is becoming outdated. There are few people anymore who speak of computers as such; they speak of systems for processing data which combine many electronic computers, frequently located not only in different cities, but also in different countries and different continents. The first example of such a computer network was the ARPA network which was developed in the United States and put into operation in 1969. At the present time it includes several dozens of computer centers in various capitalist countries, and the total computer capacity amounts to billions of operations per second. More than 50 electronic computers of this network are engaged only in the transfer of data from one computer center to another at the requests of users. Also widely known are such networks as the Cyber-Net which belongs to the American firm Control Data and is capable of serving several tens of thousands of users from various countries, the Cyclada network which combines 16 scientific centers of France, and many others.

A certain amount of experience in creating computer networks has been accumulated in our country as well. As an experiment the Siberian branch of the USSR Academy of Sciences tested the AIST system which was developed under the leadership of a corresponding member of the USSR Academy of Sciences, A. P. Yershov. Soviet

scientists are studying with interest the experience of the computer network of the Czechoslovakian Academy of Sciences, and a collective of developers who are implementing the Akademset' plan has been created in the USSR Academy of Sciences.

But what is the work of the scientific researcher or, for example, the technologist whose working position has been hooked up to the computer network? It changes radically. The researcher no longer has to go to the library and take several months to compile a survey of literature through the ONTI. He sends a request to the computer network, say, concerning work on arsenide gallium, and within several seconds before him on the display screen appears a list of all known materials on the given subject as of the present. There is no need to waste valuable time digging through scientific and technical journals and bibliographies.

A technologist who is working with a computer network has no reason to develop a new technological process from the beginning or to go to the various other enterprises in the hope of finding some advanced practice. He enters into the computer network information about the basic parameters of the item and the permissible variants of the technology. In the archives and memory banks of the computer network a search is made for the technological process that can serve as an analogue. The technologist can obtain the most detailed information regarding the selected analogue process: the structure of technological operations, the average norms for the expenditure of materials and labor resources for each operation, and many other things, right down to the address of the enterprise where the given technological process is functioning with minimum outlays. One can request information about an individual technological process or adjust the numerical data, taking into account the specific capabilities of the equipment, and so forth. The time required for technological preparation for production is reduced tens and hundreds of times over. Roughly speaking, this means the creation of a collective intellect in the specific spheres of man's activity. It is quite understandable why the United States, for example, is investing 60 billion dollars annually in data processing systems.

But let us think about whether science as a whole is ready for such a sharp change in its style of work. Much to which we have become internally accustomed, which seems naturally obvious to us, turns out to be unnecessary under the new conditions. It is understandable that if there is no demand for individual scientific and technical articles and books, there is no need for suggestions. In technology and a large part of the natural sciences there is information which becomes outdated quickly, even if it is presented in the form of a magazine article. It is even less valuable as a section of a book: for several years pass from the time the results are obtained until the book appears in the trade network or the library! Think: a couple of minutes or a couple of years! Can there really be any doubt about the vital importance of changing the entire sphere of science and technology over to work utilizing computer networks, of course, specialized ones!

But the entire existing system for evaluating the labor of scientific workers opposes this. "That doctor of sciences has four monographs," we say with respect. Or we respectfully announce, "He is an eminent scientist, the author of more than a hundred scientific works." True, we forget that scientific

works can be inaccessible even to those interested in them, and monographs remain unsold on the shelves of bookstores. But these are particular instances. It is good that there is a final product of scientific activity by which it is possible to evaluate the work of a specific individual. Even in the Academy of Sciences where there are widespread doubts about the correctness of this evaluation, from year to year there is improvement in the form of producing manuscripts of scientific works, this fairly distorted reflection of the research.

We must decisively break away from outdated methods of summing up the results of research and even experimental design activity, which have been retained as a result of inertia in thinking. The development of new, economically substantiated criteria will inevitably require more effective assimilation of computer equipment. And it should anticipate this assimilation.

#### On Barriers Arising Within Industry

The psychological barrier alienates all of us from computer equipment. Departmental barriers, which have been discussed so much lately, play the same role, although they seem only to alienate one producer of computer equipment from another. "There is one crucial task--to overcome the lack of coordination of the actions of various departments," said Comrade L. I. Brezhnev at the 26th CPSU Congress.\* His words pertain directly to the complex problem under consideration.

The already existing history of computer equipment makes it possible to demonstrate the retarding effect of departmental barriers, including the so-called interdepartmental agreements. Let us say that in some stage of the development of computer equipment we have distributed the production of various classes of electronic computers among various departments. One department is responsible for producing large universal electronic computers, another--for producing small ones, a third--control computers and, finally, a fourth--for producing components for all types of electronic computers. For the time being this division of the zones of influence satisfies everyone and it seems that it relieves the producers of inappropriate competition. But a certain time passes and those items which turn out to be "nobody's" or questionable with respect to departmental distribution fall further and further behind the world level.

In what way does technical progress alter the initial structure of the zones of influence in computer equipment? The development of technology and knowledge has led to a situation where an electronics computer can be made with one semiconductor crystal. And here it turns out that the department responsible for producing components for electronic computers can and should produce electronic computers itself.

Now, using the "trunkline" principle of constructing a computer complex, whereby various computer equipment and entire electronic computers are connected to a single set of banks or trunklines, it is possible to arrange a complex with a fairly large capacity. Which department should handle such an electronic computer? If one takes its parameters into account, it should be handled by

\*"Materialy XXVI s"yezda KPSS," p 50.

a department that is responsible for large electronic computers. But if one takes into account the parts of which it consists, it should be assigned to a department which assimilates the production of prospective micromachines. But what happens to the Ministry of Instrument Making, Automation Equipment and Control Systems?

It might seem that the solution here lies in a periodic revision of the boundaries among departments. But this is not the case if one does not take into account certain difficulties involved in organizational breakdowns. I shall clarify this with an example.

An area which promises to produce a very great effect in the future is the development of optical electronics. In an optical electronics computer part of the information is stored and processed in optical form, that is, in the form of light signals. A certain amount has already been achieved in this area. Archive optical memory devices have been created or, in other words, a memory into which one can enter information only slowly, but the information can be retrieved repeatedly and very rapidly. The stumbling block, as usual, is new technology. But this time the production of optical elements, even though they are for information input and for components to join the optical and electronic parts of the machine, is in another department.

Enterprises of the optical industry are part of one ministry while the class of computer machines in which optical electronic computers are included is assigned to another ministry. It is possible to create a new department which would duplicate the work of two or three ministries. But organizational restructuring is not a method for advancing technical innovations into production, and this pertains particularly to the progress of computer equipment.

But how does the restructuring necessary for changing over to new kinds of computer equipment take place abroad? Is it true that when it comes to replacing fundamental physical and technical principles a western firm is more flexible than our department? There is no single answer to this question. When speaking about modification of items, competition "helps" the firm to get the economic process started. But when a need arises for radical restructuring of the technical policy, the majority of firms are not in a condition to go through it rapidly and painlessly. And one encounters this need fairly frequently in the development of electronic computer equipment. The inflexibility of the companies, particularly the large ones, is easy to explain: collectives of many thousands of developers have determined their specialization and established their customary style of work, all their experience and knowledge has been accumulated in a particular sphere, and to go beyond this sphere means increasing the risk of technical failure.

The IBM firm is known throughout the world. It's flourishing and impressive expansion were based on one global technical idea--the concept of a commercial computer as an octopus: in the middle--the brain, and at the extremes--tentacles that perform the exclusively auxiliary functions of gathering information. Everything was subordinated to this idea, right down to the principles of constructing system software. But there were scientists and engineers in the firm who thought that the future lay with "distributed" processing of information and

that it was necessary to develop computers with a different architecture. Their ideas contradicted the firm's technical policy. There was no real hope of changing this policy and therefore they were placed with a dilemma: to put up with it or leave. Some of the engineers chose the second path and organized a company that was small at the time, Digital Equipment. This firm's technical policy consisted in introducing the same "trunkline" principle of constructing electronic computers which was discussed above. This path turned out to be very promising.

No less well known are other U.S. firms in which the pivotal point of the technical policy is this combination in one computer of central and peripheral processes, whereby it was possible to create a new generation of super machines --powerful electronic computers with high productivity and parallel processing of information.

At the beginning of the 1970's one of the leading workers of the Control Data company, an engineer named Cray, began to express new technical ideas at many intrafirm conferences. Some of these ideas were known previously and were used, in particular, for the Soviet BESM-6 electronic computers. Other ideas, for example, the extensive utilization of functional models operating in parallel as part of the central processor and vector registers were advanced by Cray himself. After several years of unsuccessful attempts to convince the firm's management of the effectiveness of the new principles of the technical policy, he decided to leave and establish a new firm.

Now computer systems of the Cray brand are the fastest in the world, with a speed of information processing of 150 million operations per second and more. In turn, clients of the Cray system include military departments and large firms which produce computer equipment themselves. There is a waiting line since the production capabilities of the new firm are still weak, but with time they will obviously grow.

The two examples convince us that even the most famous firms go through not only periods of advancement or flourishing with respect to technical policy, but also periods of ossification and lack of acceptance of principally new technical ideas. I think this can be explained by the natural aging of the firm's management or, perhaps, by some other dialectical factors. This question requires further careful study.

In any case, when one thinks about assimilating new kinds of computer equipment in our country, one sees that the methods of establishing the new ones, as described above, under the conditions of the existing organizational structures are unacceptable. An individual or collective with new non-standard technical ideas, by leaving one department can only enter another department which has its own plans, its own long established list of products and its own customary technical ideas, even if they are outdated.

I do not believe that the actually existing lack of a right to develop a new direction in technical thought corresponds to the ideals of a developed socialist society. I do not believe this because I know the way in which our country has created and is creating powerful scientific production special-purpose subdivisions that are developing technical ideas which are especially

important for the state and which combine the production of products of a number of departments. It seems that economists should work on this thoroughly, for they have the cards in their hands and the game, as they say, is worth playing. For we are speaking about important components of the state's intellectual potential.

#### The Importance of a Unified Statewide Technical Policy

From what has been said above some may draw the conclusion that we should encourage any undertaking in the sphere of computer equipment. This conclusion is incorrect, and the history of the development of domestic electronic computers convinces us of this.

At the end of the 1960's our country was in the vanguard of world computer equipment. In 1967 a collective of developers under the leadership of academician S. M. Lebedev provided for the introduction of the BESM-6 machine which embodied several cardinal technical ideas that have not been surpassed up to this time. Even now, 15 years later, the BESM-6 machine is being used successfully in the country, showing its effectiveness, which is certainly no less than that of the machine of the Ye S series.

The only thing that was bad about this machine was its element base. The BESM-6 was based on discrete elements. It was necessary to step up efforts to develop a new element base while at the same time retaining the positive design ideas that were previously realized in domestic electronic computers (not only the BESM-6). But instead of this a wild outburst of departmental "creativity" began. By the middle of the 1970's our industry had developed 138 types of computers, most of which duplicated one another both in terms of their parameters and in terms of their purpose. Technically all these machines differed from one another in important ways. The unified statewide policy in the area of computer equipment was lost. Departmental interests took the upper hand over state interests, and the only way out of the situation was to implement programs for the creation of machines of the Ye S and SM series which were used in all of the CEMA countries.

In the current stage of development of computer equipment one of the main means of conducting a statewide policy in the sphere of electronic computer equipment is standardization. Standards should determine not so much the particular parameters of individual electronic computers, thus reinforcing the continued existence of all sorts of computer equipment; they should establish the main direction for their development, deviations from which are allowed only in exceptional cases in the interest of scientific and technical progress. The current standard should allow the possibility of development.

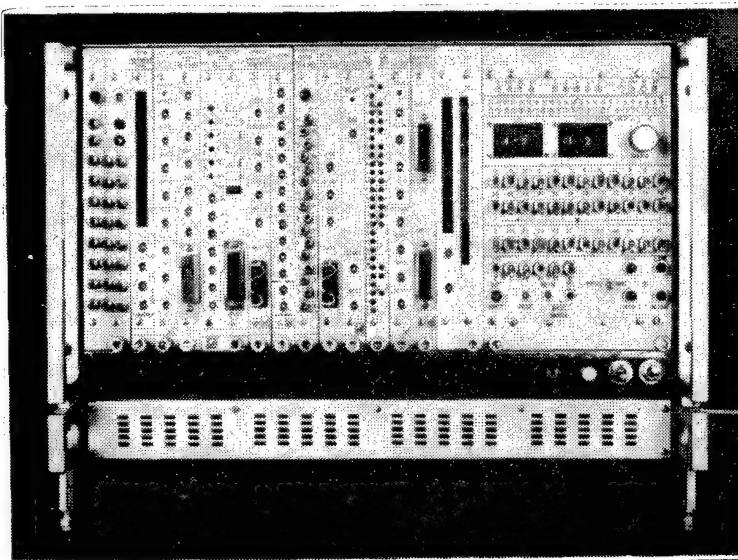
#### Now An Example From the Practice of Applying Electronic Computers

One of the most promising spheres for the application of modern computer equipment is the creation of automated systems for controlling technological processes that are based on electronic computers combined with program control equipment. But it is precisely in this sphere that departmental "creativity" is flourishing today, having made it customary to create less effective

narrowly specialized systems for solving problems of automation of specific industrial facilities.

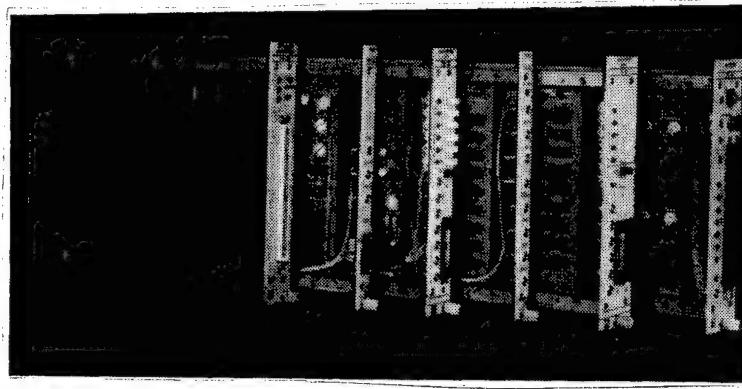
Standardization of technical means of linking electronic computers to experimental and technological installations (standardization of equipment) and technical software should be regarded as a basic solution to the problem of sharply increasing the effectiveness of automation. With automation of a specific technological aggregate or experimental installation, the automation system should be built from standard functional models as from children's blocks. This is the only way it is possible to introduce modern means of automation rapidly, which is demonstrated by the rich experience of foreign firms. The Siemens, Bausch and other firms have permitted only the development of individual modules and the construction of systems from already existing modules and new ones that have been assimilated by the firms. These firms have demonstrated the effectiveness of standardization and universalization quite clearly, both before our eyes and in our plants. They introduced an automated system for control of the rolling mill at the Cherepovets metallurgical plant in an extremely short period of time, that this period of time was unthinkable for our developers was certainly not because they are less prepared. It was simply because the West German firms adhered to a strict policy of combined standardization and unification while our developers spread their attention over a boundless multitude of problems.

Since 1971 the USSR Academy of Sciences has been increasingly publicizing, developing and actively assimilating equipment made according to the international standard CAMAC. The acronym CAMAC comes from the first letters of the English words: "Computer aided measurement and control." This applies to any process (of course, it must be subject to objective mathematical formulation). CAMAC standards give conditions for linking functional control modules which are joined into single-type unified blocks--crates, which, in turn, are joined together by a standard multiline bus--a trunkline.



CAMAC equipment: crate and exchangeable blocks.

Modules in the CAMAC system can have any function: from a set of indicators and displays to a microcomputer. The main design element of the CAMAC system is the crate. In modern English and American usage a crate is a box for fruits which is put together from slats or cardboard. The external appearance of a crate gives a fairly precise description of this equipment. The CAMAC system allows only one type of crate for 25 standard print plates--modules. Along the back wall of the crate, where the joints are located, all modules are joined together. The extreme right hand position in the crate is occupied by the control module which is intended for control and transmission of data--crate controller. Through the crate controller data is exchanged among the modules of the crate, and also between the given crate and other crates and electronic computers. There are several methods of joining the crates: an, vertical, branch and so forth. But any method of joining them provides for the operation of all functional modules that are in the joined crates as a unified measurement, computation and control device.

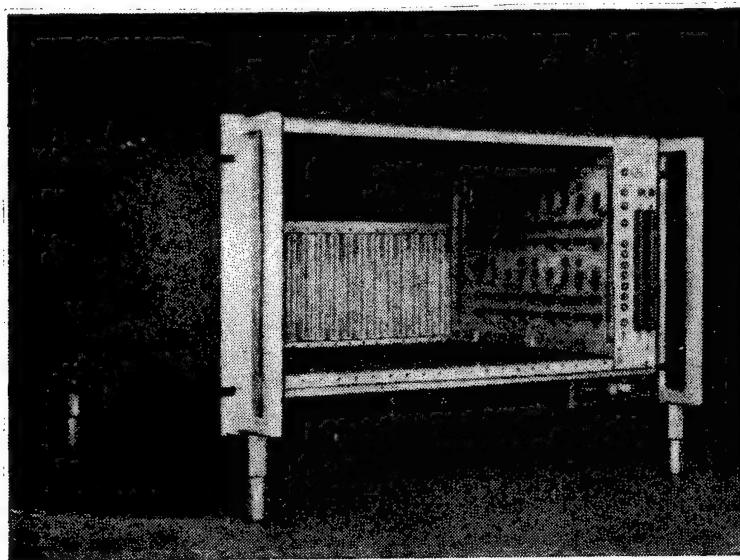


Set of standard CAMAC modules.

At the present time more than 10 countries of the world are producing more than 1,000 types of functional models that meet the CAMAC standard. The Siberian Branch of the USSR Academy of Sciences has developed more than 100 types of models, taking into account other domestic equipment, and assimilated them in production.

CAMAC standards are now registered in a large number of documents of the International Electrical Equipment Commission--in the standard IEC 516, the Institute of Engineers for Electrical Equipment and Electronics--in the standard IEEE 583, and euratom--in the standard EUR 4100. In December 1979 the USSR Gosstandard approved GOST 26.201-80, developed by the USSR Academy of Sciences, "The CAMAC System. Crate and Changeable Blocks. Requirements for Design and Interface." Control over the observance of this standard is the responsibility of the Ministry of Instrument Making, Automation Equipment and Control Systems, but so far the modules and designs in the CAMAC standard are produced only in the system of the Academy of Sciences. The Ministry of Instrument Making,

Automation Equipment and Control Systems had produced about a hundred measurement-computation complexes, which include CAMAC models purchased abroad. One of the enterprises of the Ministry of Instrument Making, Automation Equipment and Control Systems participated in the dissemination of CAMAC standards by manufacturing a batch of CAMAC blocks according to the design specifications of the Siberian Branch of the USSR Academy of Sciences valued at several million rubles. The blocks are intended for a system for controlling the RATAN-600 radio telescope.



Standard CAMAC crate. To the right of the crate--control block (controller).

As was noted, the USSR Academy of Sciences takes a most serious attitude toward the CAMAC system. As early as 1977 the president of the Academy of Sciences, academician A. P. Aleksandrov, signed an order of the Presidium of the USSR Academy of Sciences, according to which all systems for automation of scientific experimentation used by the academy's institutes should meet the CAMAC standards. But the capabilities of the Academy of Sciences to produce CAMAC equipment are considerably less than the demands of the academy itself. Taking this into account, in 1980 the Gosplan, the USSR State Committee for Science and Technology and the USSR Academy of Sciences adopted a statewide special-purpose program, "The Creation and Development of Automated Systems for Scientific Research (ASNII) and Systems for Automated Planning (SAPR) Using Standard CAMAC Equipment and Measurement-Computation Complexes." Participating in the program are the USSR Academy of Sciences and a number of ministries and departments, and it fully meets the instructions of the "Basic Directions for the Economic and Social Development of the USSR During 1981-1985 and the Period Up To 1990": "To expand automation of planning-design and scientific research work using electronic computer equipment."\*

\*"Materialy XXVI s"yezda KPSS," p 144.

The measures listed above show that we are beginning to consistently implement a unified statewide policy in the area of effective utilization of computer equipment. They give us hope that there will be no repetition of that excessive weakness in the administration of branch science which existed at the end of the 1960's with respect to the development of new computers.

#### The Effectiveness of Electronic Computers and the Deceptive Indicators of Well-Being

When people say that our country needs hundreds of thousands of computers or demonstrate how quickly we are approaching this goal, the figures they give arouse no joy in me. The fact is that more than 15 people are required to service the average electronic computer of the Ye S series with the present level of durability. Hundreds of thousands of installed computers involves millions of workers who are taken away from production.

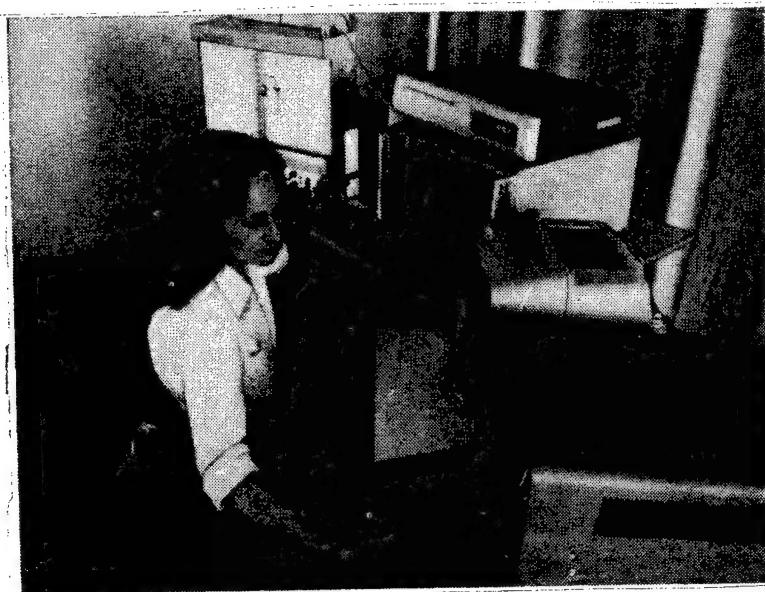
Regardless of how great the "calculated effectiveness" of the application of electronic computers may be if it only includes the wages of the previous number of bookkeepers with the addition of 15 service people, one cannot believe in this "effectiveness." Perhaps only the miracles of setting them up can be compared to the mysticism of figures that show the effectiveness of operation. It is not unusual for the normative time period for setting up an electronic computer to be 3-4 months. And this is four machines that are made in several weeks! Externally everything looks good: The electronic computer has been produced, its capacity is great, many hundreds of square meters have been prepared for it, the service personnel have been hired according to staff normatives, and the document for completion of setting it up has finally been signed. The report is up to date but the fact that the electronic computer does not operate for many months after this and it must be put into working condition through one's own efforts, this is not in the report, and who is going to complain about himself! After all, as usual, the money was paid in advance, when the electronic computer was still in the shop, and another organization sets it up. And the longer it takes to do this, the more it earns . . . .

During the past years of familiarization with the electronic computers many of us have become accustomed to the fact that in addition to the machine there must be an operator--a young creature who is proud of the fact that he knows which button to push to start up the machine. The existance of these people along with the electronic computers is only a weak and unsuccessful attempt to compensate in some way for the shortcomings in the equipment. It becomes advantageous to conceal the down time of the electronic computers and thus cover up not so much one's own mistakes, but defects that appeared during planning and manufacture. Instead of putting a new, highly-effective instrument in the hands of the researcher, engineer or technologist, we put him up against a new microdepartment which has its own microinterests.

There is now a need to take statewide measures to reduce the number of service personnel for electronic computers. The central point of these would be measured to increase the reliability of computer equipment and eliminate the need for excessive labor expenditures on servicing it. Standard staff lists,

the composition of technical and mathematical documentation and the collective service of each electronic computer that is produced should be under strict state control. This is precisely the way in which we can make a preliminary judgment about the quality of the electronic computer and not about the sum of money that has been invested. Moreover it would be expedient to work constantly on developing electronic computers, and it is necessary to disassemble some of the electronic computers that require increased expenditures on servicing and to transfer some of the machines to training institutions and schools where they can be used as training aids. This work should be done centrally, on a planned basis.

Direct access to the electronic computer for the user who is not a specialist in the area of computer equipment, but a specialist in the area where the machine will be used is the main thing in effective utilization of the machines today. This clear effect has led to the creation and extensive dissemination in a number of countries of the personal computer, that is, a computer which does not require permanent service personnel since everything required for operation is simple and can be done by the user himself. The personal computer does not require special premises, it occupies little space and, of course, it has developed service program software. Specialists adapt very quickly to work with a personal computer, and the fact that we have begun to extensively use household equipment as peripheral devices for electronic computers--television sets, tape recorders and the telephone network--contributes to this. The personal computer can be operated separately or it can be hooked up to a computer network if there is one nearby.



Personal computer: system based on Elektronika-60 microcomputer and CAMAC equipment. The graphic devices--a television-recorder --provides for immediate representation of information.

Only a user who has worked independently on a personal computer or with a terminal of a large electronic computer can really evaluate the effectiveness of the application of computer equipment. One can say nothing about the effectiveness of this equipment by looking at the favorable figures of statistics.

#### The Lessons of Service

Lately there are fewer and fewer organizations which will voluntarily take on a large amount of responsibility. This general tendency is emphasized by the creation of associations of the Soyuz EVMkompleks type--organizations intended for centralized technical servicing of computers. If we look at analogous foreign organizations operating both in capitalist and in socialist countries, all of them are fully responsible for each minute of down time of electronic computers that is caused by them. But here it is the opposite. The organization which should bear responsibility for the operation and down time most frequently comes between the consumer and the producer, and has received the right to take charge of all spare parts for the electronic computers it services. So even if an organization with an electronic computer has the capability of ending the down time through its own forces, it must wait for months until the service firm provides spare parts, after which this firm, naturally, disclaims all responsibility. A dictatorship over the consumer has been formed in an artificial way and a possibility has been created of "driving" him into any situation. Whether the electronic computer works or not, everyone receives "their own" money. . . .

We borrowed the system of operation of service organizations, whereby their representative comes upon receiving a phone call, from the work practice of similar firms in industrial developed countries and those with small territories. In places where the distances are small and the communications operate excellently, this system of operation justifies itself. But the Novosibirsk division of Soyuz EVMkompleks services a territory that is larger than the territory of all Europe outside the USSR. Even if this territory had a European communications network no one would be able to arrange effective servicing of technical equipment from one center. In attempts to escape this situation, we are beginning to create dwarf sections for servicing electronic computers. All their shortcomings are brought about by their size and the lack of personnel: rented facilities that are poorly adapted for their work, the lack of the proper control, poor discipline and, as a result, the impossibility of attracting highly skilled personnel who are in short supply. In addition to the fact that this results in poorer quality of service, it becomes tempting to take the incorrect path of attracting personnel with wage bonuses. As a result, we spend twice as much state money to pay for service and the effectiveness of this service continues to be poor. And even the user can no longer try to improve it since money is a necessary condition and not a form for evaluating their work.

This is not simply a matter of difficulties in establishing new organizations. Here is one example. In order to conduct a number of scientific experiments it turned out to be necessary for the USSR Academy of Sciences to provide for the joint operation of two computers, one of which was located in Moscow and the other in Novosibirsk. The Ministry of Communications requested no more

or less than 174,000 rubles a year based on 15 kopecks a minute to pay for private interurban negotiations that lasted 24 hours a day and all year. With this kind of payment, in a year the cost of the communications channel would be equal to the cost of one of the computers. But the ministry decisively rejected all our proposals to pay not for a year of operation of two telephones, but only for communications sessions. The considerations are quite understandable: When one pays for communications sessions extra difficulties can arise if the communications are not established. It is necessary to figure out the reason for this. It is much more simple to sell the communications channel for a year all at once, ridding oneself in one fell swoop of tiresome concerns and responsibility.

There is much that indicates that in its present functioning computer equipment facilitates . . . the retention of shortcomings in the economic mechanism. When machine tools stand idle at a plant this fact is finally reflected in the report and in the plan. We know that mathematical software for electronic computers is, in a certain sense, equivalent to equipment. And the highest achievement for a programmer is presently considered to be releasing the programs he has developed to the state fund of algorithms and programs. And it does not make any difference that the machine tools are released to a storehouse worker who is not interested in operating these machine tools and is responsible only for storing them. World experience has demonstrated the effectiveness of an approach whereby the firms that produce electronic computers provide for the storage and increased supplies of programs for the machines they produce. So why create various intermediate organizations which are not motivated for anything and which find it easy to avoid unnecessary responsibility?

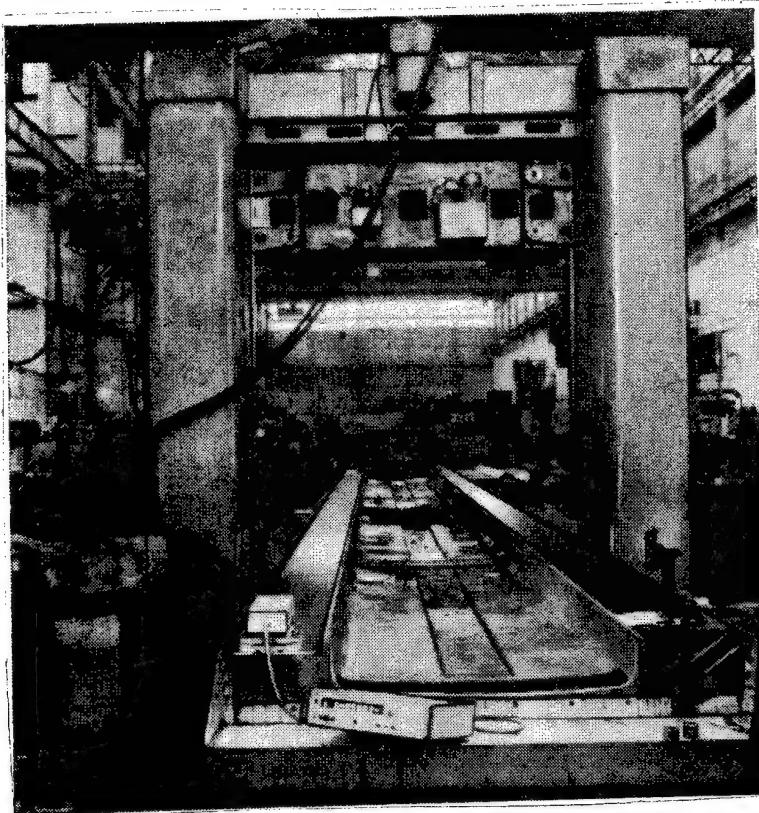
The most crucial problem is that of an interested and responsible person in charge of mathematical software. Why have the departments that produce computer equipment ceased to fulfill this role? This is apparently related to the fact that their interests do not coincide with the interests of the national economy.

#### Feedback Between Computer Equipment and Industrial Technology

The lack of concern for program software ends up for the same department in arrears in production technology. There is a strict reverse connection between the level of existing computer equipment and the level of industrial technology that is achieved. Without modern technology one cannot arrange the output of reliable and effective computer equipment, and without the participation of computers to control technological processes one cannot reach the modern level of technology, especially the technology of the production of data processing systems.

If we superimpose this reverse connection on the existing organizational structure we discover that the reverse connection is cut off by organizational barriers which do not correspond to the logic of the goals. Every department is interested in having modern technology and would have nothing against utilizing computers in this technology. The workers of this department could even recognize that without good electronic computers there will be no good technology. But from whom can they request good machines or even with whom can they make an agreement? Under conditions whereby many departments are

responsible for the production of computer equipment, it actually remains without any one being responsible. This is precisely why each ministry which has the very minimum capabilities begins to produce its own equipment and to assimilate the production of computer devices that are home-made or borrowed from somewhere outside.



Assembly and adjustment of heavy machine tool with laser interferometer at the Novosibirsk Tyazhstankogidropress plant.

This practice can be stopped only by statewide special-purpose programs of the type which was already mentioned. Only properly financed and controlled special-purpose programs can provide for effective functioning of the reverse connection between computer equipment and industrial technology.

The experience in creating the best domestic computers shows that one can achieve good results primarily in a special-purpose scientific production association with the help of a collective whose own existence depends on a specific goal. And if there are numerous documents for transferring one job from hand to hand--from the scientific research institute to the design bureau, from the design bureau to the experimental plant, from the experimental plant to series production--one cannot hope for the technical equipment that is developed to be effective. Moreover the very existence of all those parties

participating in the creation of a new item is not determined by the results that are achieved; each of them has particular goals and tasks which are not directly related to the effectiveness of the future technical equipment.

Special-purpose programs should not involve just organizational issues like the creation of special-purpose scientific production associations; purely economic problems should also come within the realm of their competence.

Let us consider, for example, the process of setting prices of batching items for electronic computers. Microcircuits with a high level of integration--so-called large integral circuits (BIS)--can contain tens of thousands of elements. The prices for such BIS's that are manufactured domestically are approximately ten times as high as they are for similar microcircuits produced in developed countries. This is explained by the high proportions of rejected work in the production of domestic BIS's. At the same time the prices of microcircuits with less integration are constantly dropping at the same rapid rates as they are abroad. This is understandable: the technology that has been developed makes it possible to increase the percentage of output of suitable small integration circuits. But their application involves large losses of money and time.

Let us now consider prices from the standpoint of the developers of computer equipment. What does their existing price structure for batching items cause? It causes technical progress to turn around. It makes it necessary to use obsolete components in the item. This connection between computer equipment and industrial technology changes from a stimulator into an impediment to scientific and technical progress.

A special-purpose program must envision surmounting such situations so that the unlimited power of the producer of technical equipment no longer plays its negative role.

Much can be said about modern problems with computer equipment, problems which are equally technical, economic and even social. But the main thing the experience in the development of electronic computer equipment tell us is that it is necessary to have a common goal, a common technical policy and a common approach to the effectiveness of computer equipment.

A certain restructuring of awareness is necessary in order to understand that effective application of computer equipment is not simply one of a multitude of equivalent components of scientific and technical progress, but a component which is increasingly becoming a major condition, a catalyst for the development of the national economy.

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## SIBERIA TO SUPPLY COUNTRY'S ENTIRE GROWTH IN FOSSIL FUEL OUTPUT

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Article by Yu. I. Maksimov, doctor of technical sciences, Institute of Economics and Organization of Industrial Production of the Siberian Branch of the USSR Academy of Sciences (Novosibirsk): "The Fuel and Energy Complex of Siberia"<sup>7</sup>

Text<sup>7</sup> If one were to take two contour maps of our country and enter on one of them the fuel extraction regions and on the other, the energy consuming regions, not only would there be an essential difference in the intensiveness with which various parts of each of these maps is colored in, but also the regions colored in with maximum intensiveness would practically not coincide. The shift of the increase in supplies of fuel and energy resources to the northern and eastern regions of the country and also the inertia and the traditional approach to the distribution of the fuel- and energy-intensive industries mainly in the European part of the country cause an essential increase in the total flow of fuel and energy resources from Siberia to the European part of the country. For example, during 1971-1980 the total flow of fuel and energy resources from Siberia to the European part of the country increased almost 6.4-fold.

According to various prognoses, by 1990 the total flow of fuel and energy resources from Siberia to the European part of the country can increase 1.4-1.6-fold as compared to the volumes reached at the end of the 10th Five-Year Plan, and by the year 2000--1.7-2-fold. The growing flows of fuel and energy resources from the east to the west are causing an increased load on the related branches of the national economy.

Improvement of the proportions between energy and the entire national economy was brought up in the materials of the 26th CPSU Congress as one of the most important problems. Siberia's role is increasing as a leading energy base for the country, which in the near future will not only provide for the entire increase in the extraction of the main fuel and energy resources, but will also compensate for the decreased extraction in a number of gas, petroleum and coal regions of the country.

The development of the Siberian fuel and energy complex during the past 30-35 years can be divided into two periods:

- 1) before 1965, when only coal was mined in Siberia. The extraction of petroleum and natural gas was insignificant and practically did not effect the development of the country's fuel and energy complex;
- 2) from 1965 to the present. The Western Siberian petroleum and gas complex began to form and develop, and now it provides for more than half of the all-union extraction of petroleum and more than one-third of the all-union extraction of natural gas. The coal industry's proportion is decreasing (while the extraction of coal is still increasing).

With the intensive formation and development of the Kansk-Achinsk fuel and energy complex (KATEK), a third period in the development of the extraction of fuel and energy resources in Siberia can begin. It will be characterized by stabilization and then, perhaps, an increased proportion of the coal industry in the total extraction of fuel and energy resources in Siberia.

One can conventionally consider the year 1965 to be the beginning of industrial development of the gas and petroleum deposits in Siberia, but the extraction of hydrocarbon raw material was still extremely insignificant that year: less than 1 million tons of petroleum and less than 10 billion cubic meters of natural gas were extracted. By 1980 the annual extraction of gas in Siberia had increased by almost 150 billion cubic meters, petroleum with condensate--by more than 312 million tons, and coal--by 82 million tons.

The extraction of hydrocarbon raw material in Siberia (petroleum and gas condensate, natural gas and casinghead gas) developed more intensively under the 10th Five-Year Plan. We obtained 78.8 percent of the increase in the extraction of natural gas and 52.9 percent of the increase in the extraction of petroleum which was achieved during the preceeding five-year plans taken together.

The increase in the extraction of hydrocarbon raw material in Siberia during 1966-1980 exceeded the increase in the extraction of coal almost 12-fold. And at the end of the 10th Five-Year Plan the extraction of hydrocarbon raw material exceeded the extraction of coal more than 4.2-fold. The total extraction of the main fuel and energy resources (coal, petroleum and gas condensate, natural gas and casinghead gas) increased more than 8-fold during 1966-1980. Moreover, the extraction of fuel and energy resources more than doubled during the 10th Five-Year Plan (see Table 1).

In Siberia as a whole under the 10th Five-Year Plan the increase in the extraction of the main kinds of fuel and energy resources amounted to 409.2 million tons of conventional fuel. The petroleum extraction industry provided for 57.7 percent of the increase, the gas industry--38.9 percent and the coal industry--3.4 percent.

During the 15 years under consideration there was a constant reduction in the proportion of the Siberian coal industry (from 98.6 percent to 19 percent) even though the absolute amount of coal extraction increased. And the proportion

of the gas and especially the petroleum extraction industry increased: Even at the end of the 9th Five-Year Plan petroleum extraction provided for more than half of the extraction of the main fuel and energy resources in Siberia (see Table 2). During 1966-1980 as a whole the proportion of the hydrocarbon raw material increased from less than 1.5 percent to 81 percent.

Table 1. Extraction of Fuel and Energy Resources, Millions of Tons of Conventional Fuel

	1965	1970	1975	1980
USSR	881	1182	1509	1853
Siberia	99	168	392	801
Including				
gas	0.01	11	42	202
petroleum with condensate	1	45	212	447
coal	98	112	138	152
Proportion of Siberia, %	11	14	26	43
USSR = 100%				

Table 2. Change in Proportions of sub-branches of the Siberian Fuel and Energy Complex, %

Sub-branches	1965	1970	1975	1980
Gas industry	0.01	6.6	10.8	25.2
Petroleum industry	1.41	26.6	54.0	55.8
Coal industry	98.58	66.8	35.2	19.0

Thus under the 10th Five-Year Plan the proportion of petroleum practically stabilized in the Siberian fuel and energy complex (during the five-year plan it increased by only 1.8 percent), there was a considerable increase in the proportion of gas (from 10.8 percent in 1975 to 25.2 percent in 1980) and there was a marked reduction in the proportion of the coal industry (from 35.2 percent in 1975 to 19 percent in 1980).

The structural changes in the fuel and energy complex of Siberia were determined largely by the intensive development of the Western Siberian petroleum and gas complex which was called upon to solve four most important national economic problems:

to make up for the shortage of high-quality fuel and energy resources in the European part of the country and the Urals;

to contribute to the acceleration and intensification of the development of fuel- and energy-intensive industries in Siberia;

to essentially increase the degree of the use of gas in the Siberian economy;

to increase the export of gas, petroleum and products from processing them, having essentially increased the proportion of products from processing.

The utilization of petroleum and gas resources of Western Siberia has a history of only 15 years. But by the beginning of the 10th Five-Year Plan, that is, approximately 10 years, Western Siberia became one of the main petroleum and gas extraction regions of the country: In 1975 more than 210 million conventional tons of petroleum (30 percent of the unionwide extraction) and more than 40 million conventional tons of gas (12.3 percent of the unionwide extraction of gas). By the end of the 10th Five-Year Plan every second ton of petroleum extracted in our country and every third cubic meter of natural gas were Siberian. In the future the Siberian petroleum and gas complex will also have a greater influence on the world fuel and energy markets.

In the near future the development of the productive forces of Siberia, including the creation of fuel- and energy-intensive industries here, will rely on the Western Siberian petroleum and gas province. The assimilation of the Western Siberian petroleum and gas province, which is entering the second stage of its development, is a complicated comprehensive problem of unionwide significance. It should be resolved on the level of a national program.

There is to be an essential restructuring of the final product of the Western Siberian petroleum and gas complex.

By the beginning of the 10th Five-Year Plan the proportion of petroleum amounted to 84 percent of the extraction of fuel and energy resources in the Western Siberian petroleum and gas complex, and gas provided 16 percent. At the end of the 10th Five-Year Plan the proportion of petroleum amounted to 70 percent, and gas--30 percent. The Basic Directions for the Economic and Social Development of the USSR During 1981-1985 and the Period Up to 1990, give the instruction: "To provide for further development of the largest territorial production complex in the northwest of Siberia. By 1985 to increase petroleum extraction here, including gas condensate, to 385-395 million tons, and gas--to 330-370 billion cubic meters."

In 1985 the proportion of petroleum should be 55-58 percent, and the proportion of gas--42-45 percent. The five-year plan that was adopted, the above-noted intervals of the development of the Western Siberian petroleum and gas complex were specified for the end of the 11th Five-Year Plan in the following volumes of extraction: petroleum--395 million tons and gas--356 billion cubic meters. The proportion of petroleum was 57 percent of the extraction of fuel and energy resources, and the proportion of gas--43 percent.

An analysis of the prospects for the development of the Siberian fuel and energy complex shows that the probability of overfulfilling the plan for the extraction of gas is significantly greater than the probability of overfulfilling the plan for the extraction of oil. But even with the most optimistic variant of the overfulfillment of the plan for the extraction of gas by the end of the 11th Five-Year Plan, the contribution of the petroleum extraction industry to

the development of the Siberian fuel and energy complex will be greater than the contribution of the gas industry. But even by 1990 the proportion of gas should exceed the proportion of petroleum. Thus in the near future the Western Siberian complex will be transformed from a petroleum and gas complex to a gas and petroleum complex. And the related branches of the national economy should adjust to this essential restructuring.

Improvement of the structure of the final output of the Western Siberian petroleum and gas complex, naturally, will also depend on maximally increasing the degree of utilization of casinghead gas from petroleum deposits and condensate from gas condensate deposits. On the one hand, inadequate utilization in the national economy of casinghead gas from petroleum deposits leads to the need to discover, build up and operate an additional number of gas deposits. On the other hand, a large quantity of condensate left in the bed will lead to the need to discover, build up and operate an additional number of petroleum deposits.

The materials of the 26th CPSU Congress emphasized that the effectiveness of the development of the national economy can be significantly increased as a result of overcoming a number of tendencies toward inertia that have already become customary. One of these is the attitude toward deposits of hydrocarbon raw material as having only one component. Efficient use of all valuable components, despite the complex geological structure of the deposits, will make it possible to significantly increase the effectiveness of the development of the Western Siberia petroleum and gas complex. The fact that a deposit of hydrocarbon raw material with only one component is the exception rather than the rule, is shown, if only by this circumstance: By the end of the 10th Five-Year Plan enterprises of Glavtyumengeologiya discovered on the territory of Northern Tyumen Oblast 42 deposits of hydrocarbon raw material that were very different--20 gas condensate, 11 gas condensate-petroleum, 3 gas-petroleum, 1 petroleum with a gas cap, and only 5 purely gas and 2 purely petroleum deposits. In connection with what has been said, it seems expedient to investigate the problem of combining petroleum and gas extraction into an independent Ministry of Extraction of Hydrocarbon Raw Material.

Intensive development of the Western Siberian petroleum and gas complex contributed to the fact that under the 10th Five-Year Plan there was a considerable increase in the share of the Siberian fuel and energy complex in the total extraction of fuel and energy resources in the country (see Table 3 and Table 1). There was a corresponding increase in Siberia's role in providing for the growth of these resources (see Table 4).

Table 3. Proportions of Gas, Petroleum and Coal from Siberia in the Unionwide Extraction, USSR = 100%

	1965	1970	1975	1980
Gas	0.007	4.7	12.3	39.0
Petroleum	0.4	8.9	30.1	51.9
Coal	25.6	27.2	29.8	32.1

Table 4. Changes in Increases in Extraction of Main Fuel and Energy Resources in USSR and in Siberia

Indicators	Five-Year Plans		
	8th	9th	10th
Increase in extraction in USSR, millions of tons of conventional fuel	301	327	344
Increase in extraction in Siberia, millions of tons of conventional fuel	69	224	409
Siberia's proportion	0.23	0.69	1.19

In the near future the Siberian fuel and energy complex will not only provide for the entire increase in the extraction of gas, petroleum and coal in the country, but will also compensate for the reduced volume of extraction in other regions of the country. The 11th Five-Year Plan will be a kind of landmark in the development of the Siberian fuel and energy complex. It is intended to extract more than half of the country's main fuel and energy resources here.

There are various predictions of the development of the fuel and energy complex, including up to the years 2030 and 2050. But the most interesting is an analysis of its development during the next 20 years, since during this period there can be qualitative changes in its structure which are brought about by the change in previously existing tendencies. For example, petroleum and natural gas can become significantly more costly.

The main factor making petroleum more expensive will be the changeover to working deposits with relatively small supplies and worse mining and geological characteristics, which can be expressed, in the final analysis, in a reduction of the average yield from oil wells.

Natural gas will become more expensive because of its transportation. Approximately 70 percent of expenditures on the gas industry go for highway transportation of gas. The assimilation of deposits in the northern regions of Tyumen Oblast led to a considerable increase in the average distance for the transportation of gas, and also the rayon coefficient of cost increase. But if the reduction of the supplies of the deposits and the deterioration of their mining and geological characteristics do not tend to stabilize, the increased average distance for the transportation of gas and the regional coefficient of cost increase will stabilize in the near future.

According to the Basic Directions for the Economic and Social Development of the USSR During 1981-1985 and the Period Up To 1990, Siberia's proportion in the country's fuel and energy complex should increase to 53.5 percent. According

to the author's estimates, Siberia's proportion in the extraction of the main fuel and energy resources can increase to 57-60 percent within a couple of decades, and soon after that even to 64-68 percent. Moreover, by 1990-2000 there should be an essential change in the interregional proportions of the Siberian fuel and energy complex. While the main gas extraction region of Siberia will still be the north of Tyumen Oblast, where the extraction of gas from the Urengoy deposit alone can reach the level of 100 billion cubic meters a year, the Western Siberian petroleum and gas province does not promise such dynamics, and therefore it is necessary to actively develop search and prospecting work and petroleum extraction in Eastern Siberia, where even in the near future there should be formed a petroleum region whose potential approaches that of the Western Siberian petroleum complex.

At the present time there is a fairly high degree of technical and economic uncertainty about the possibilities of extensively utilizing various new technologies for obtaining energy which could replace petroleum and natural gas in the country's fuel and energy complex. But the prospect of a marked increase in the cost of hydrocarbon raw material should be regarded as a main factor in the intensification of research on the development and application of new technologies for obtaining energy (solar, geothermal, economical utilization in the national economy of gas hydrate deposits and so forth). The limitations of resources of inexpensive petroleum also make it crucial to intensify research on creating and utilizing as quickly as possible technologies for obtaining synthetic liquid fuel. Synthetic liquid fuel from natural gas can be considerably less expensive than synthetic fuel made from coal.

Supplies of natural gas on the Yamal peninsula and prospects for economic assimilation of the USSR Arctic zone make it expedient to investigate problems of developing gas extraction in the Yamal-Gydansk region for the production of synthetic liquid fuel.

The near future of the development of the Siberian fuel and energy complex should be characterized not only by increased extraction of the main fuel and energy resources: coal, petroleum and gas condensate, natural gas and casinghead gas. It is necessary to develop electric energy at more rapid rates, primarily on the raw material base of inexpensive Kansk-Achinsk coal and the high-quality (both technologically and ecologically) energy bearer--natural gas. The development of electric energy in Siberia at more rapid rates will make it possible to create energy-intensive industries here and to form highly productive territorial production complexes (TPK) in the future.

In order for the Siberian fuel and energy complex to develop at more rapid rates, in the near future it is necessary:

to reduce as much as possible the various losses of fuel and energy resources (during extraction, transportation, processing and consumption);

to utilize fuel and energy resources more economically;

to give preference to less energy-intensive and fuel-intensive variants of planned machines, mechanisms and technological processes.

While previously when selecting various variants of machines, mechanisms and technological processes we did not always take into account the requirement of minimizing fuel and energy consumption, in the near future these requirements will become basic ones.

The near future of the development of the Siberian fuel and energy complex includes the establishment and development of the synthetic liquid fuel industry. In the first stage the raw material base for effective development of this industry is gas deposits, and then the practically unlimited supplies of coal in the Kansk-Achinsk basin.

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## RISE IN WAGES MUST REFLECT RISE IN PRODUCTIVITY, QUALITY

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Article by M. I. Belkin, doctor of economic sciences, VNIIPT of Petrochemical Equipment, Volgograd, and V. A. Volkonskiy, doctor of economic sciences, Central Economics and Mathematics Institute of the USSR Academy of Sciences, Moscow: "Regulation of Wages and Interests of Production."<sup>7</sup>

Text<sup>7</sup> The national economy is experiencing a critical shortage of labor resources. This is usually related to the complex demographic situation and the exhaustion of employment reserves. These factors in the reduction of the flow of labor force are actually in evidence. But they do not justify the shortcomings in planning and the lack of perfection of the economic mechanism, which lead to a lack of correspondence between the number of jobs and the availability of workers.

Because of the reduction of the flow of labor force, the role of planning and economic stimulation consists in selecting those economic measures, those variants of the development of production whereby the available labor resources are utilized with the greatest efficiency. The economic mechanism is called upon to increase the motivation of organizations of all levels of the economic hierarchy to reduce the demand for labor resources, to avoid the unjustified expansion of staffs, to increase the skills of workers and to raise the educational level of the youth.

One of the main instruments in the formation of these stimuli is the system of wages. Its functions can conventionally be divided into two groups: 1) regulation of the ratio between the wages of various categories of workers in the interest of increasing the efficiency of labor; 2) increasing the wage fund in keeping with the capabilities of producing consumer goods.

### Wages and the Dynamics of Wage Rates

The system of wages in operation in industry can be reduced to three main kinds: piece-rate and time-rate for workers and salaries for engineering and technical personnel and employees. Two groups of functions of wages in various systems of payment are provided by various means. For piece-rate wages the main instruments are wage rates and time and output norms. For

time-rate wages--wage rates and service norms. For regulation of wages for engineering and technical personnel and employees (including workers in science and scientific service) there is the system of limitations on salaries and the staff distribution in keeping with the organizational structure of the enterprise or institution, and also models for salaries and systems for awarding bonuses.

The first of the systems produces the least possibility of centralized regulation of wage increases. Both piece-rate workers and time-rate workers can increase their earnings by increasing their skills. But piece-rate workers have the additional possibility of considerably overfulfilling the output norms.

Ideally the output norms are determined by the technical parameters of the machines and the production technologies whose planning is related to the psychophysiological labor norms. But the technical characteristics of the machines frequently exceed the socio-economic limits of their utilization. Therefore one frequently applies not technically but socially substantiated output norms. Since the technical and technological conditions even at enterprises that are most similar in profile, as a rule, differ essentially, norm setting for labor is to a considerable degree decentralized.

Work is being done systematically to improve and unify output norms. The calculation of norms on the basis of interbranch and branch normative materials will serve to radically improve norm setting for labor. But in practice the utilization of these norms is impeded by shortcomings in the wage rate system, particularly, the narrow framework of variations within the limits of one contract. When wage rates do not correspond to economically justified differentiation of wages for workers with various occupations and qualifications because of differences in working conditions, its complexity and intensiveness, output norms assume the functions of regulating wages.<sup>1</sup> This becomes especially noticeable when wage rate systems become outdated. The average percentage of fulfillment of the norms usually decreases with a changeover to new conditions for wages, and then gradually increases right up to the next revision of the wage rate conditions. Thus in 1974 the level of fulfillment of the norms reached 131.8 percent; by 1976, after the completion of the changeover to the new wage conditions it decreased to 118.8 percent; and then it regularly rose again: 1977--119.6 percent, 1978--120.1 percent, 1979--120.2 percent, and 1980 (April)--121.2 percent.

In recent years a number of measures have been taken to stimulate the change-over to technically substantiated norms. The State Committee for Labor and Wages has been granted the right, with the agreement of the AUCCTU, to permit the ministries and departments to introduce increased (up to 20 percent) increments for work according to these norms in production associations and enterprises of individual branches of industry. This is especially effective in machine building. Moreover, the initiative to introduce technically substantiated norms and revise them is accompanied by a 1-time remuneration for workers from the fund created by savings from these changes. But only 8 percent of the technically substantiated norms that are in effect in industry are established on the level of the standard norms. Norms that are considerably lower than the standard output norms are widely used. Thus at the Nikolayev

confectionary factory they are 42 percent lower than the standard, the Zhdanov--36 percent, and the Zhitomir--19 percent; the overfulfillment amounts to 25, 23.3 and 19 percent, respectively. Sometimes the standard norms themselves are reduced. Thus the output norm at the Kiev confectionary factory imeni K. Marx is 14.9 percent higher than the standards, but it is fulfilled by an average of 120.6 percent.<sup>2</sup> In the RSFSR textile industry 81.3 percent of the spinners and 70.4 percent of the weavers work with normatives that are higher than the branch normatives. This is explained primarily by the fact that the branchwide norms have not kept up with the distribution of new equipment and new technology.

The category of the piece-rate worker thus has little influence on the level of his earnings. Conversely, the earnings of time-rate workers depend directly on their category and the corresponding wage rate. This increases mainly as a result of a higher average category of workers. Thus centralized regulation of earnings is limited by the fact that it is difficult to control the correctness of the assimilation of skill categories of auxiliary workers in keeping with the wage rate and skill category guidelines. Wage rate conditions are periodically revised when most of the workers reach or come close to the highest possible categories. The wage level that is reached is registered in the system of new wage rates (with the corresponding change in the category).

#### Is Wage Rate Control Effective?

The wage rate part of the earnings is related to the relatively stable characteristics of labor which cannot account for all the individual differences of the workers (their abilities, production experience, attitude toward labor, mastery of related occupations and so forth). Within the limits of one and the same category the level and quality of labor operations differ considerably. Therefore it has become crucial to increase the flexibility of the wage rates, especially time-rate payments, which still provide little motivation for the workers to increase the results of labor. The inadequate flexibility of wage rate conditions, especially when they have been in effect for a long time, leads to a decline in the role of the wage rate part of the earnings and reduces its proportion in the wage fund since the additional forms of earnings increasingly assume the stimulating function. Enterprises make lesser demands on the policy for establishing wages and have less control over them.<sup>3</sup>

Increments and payments in addition to the wage rate (salary) serve as an<sup>4</sup> effective means of accounting for the individual qualities of the worker. The decree of the CPSU Central Committee and the USSR Council of Ministers, "On Improving Planning and Stepping Up the Influence of the Economic Mechanism on Increasing the Efficiency of Production and the Quality of Work," stipulates the right to pay a whole number of increments from savings on the wage fund. Among them are: 1) for combining occupations and performing the established volume of work with a fewer number of workers--up to 50 percent of the wage rate (salary); 2) additional payments for workers for high occupational mastery--4.8 and 12 percent of the wage rate of the appropriate category; 3) for advanced skills of engineering and technical personnel, mainly masters and also employees--up to 30 percent, and designers and technologists--up to 50 percent of the salary.

The introduction of increments and additional payments undoubtedly facilitates the wage rate system. But their influence is limited: because of their very meaning and the procedure for establishing them, and also because of the sources of the money, they extend to far from all workers. Hungary and Romania apply a flexible form of accounting for the personal peculiarities of the workers and the results of their labor, and differentiated payments within each wage rate category. In Hungary this is a difference in payments (now with a range of up to 40-50 percent) and in Romania--degrees and gradations. In all of the CEMA countries (except for Poland) the differences in wage rates (salaries) are applied for paying engineering and technical personnel.

Table 1. Wage Rate Schedules in Effect Before and After the Revision in December, 1972

Hourly wage rates with normal working conditions  
for various categories of time-rate workers,  
kopecks

Periods of Effect	I	II	III	IV	V	VI
From April, 1959 through December, 1972	27.5	31.1	35.3	40.7	37.3	55.0
Since December, 1972	41.8	45.5	50.0	55.7	62.7	71.7
Increase in wage rates, %	152.0	146.3	140.7	136.9	132.6	130.4
1972 category (in numerator) corresponding in wage rate level to 1959 category (in denominator)	--	--	--	$\frac{1}{4}$	$\frac{2.4}{5}$	$\frac{4}{6}$

The extreme amount of the average earnings which is retained in industry in addition to the limitations on the wage fund and the number of industrial production personnel, despite the criticism from the press, remains a serious limitation on the independence of the enterprises to vary the earnings of time-rate workers and also engineering and technical personnel and employees. The negative consequences of limiting the average earnings are especially noticeable because of the shortage of labor force. They force the managers of enterprises to retain extra low-paid workers or those who are not fully employed in order to increase the wages or the number of highly skilled workers and specialists.

#### Wage Rates and Bonuses

Bonuses play an important role in accounting for the labor contribution of individual workers and also collectives. Indicators and conditions for awarding bonuses differ greatly, depending on working conditions and the functions of various groups of workers.

When awarding bonuses to piece-rate workers who service machine tool equipment in machine building, the textile industry and wood processing, incentives are applied for fulfillment and overfulfillment of technically substantiated norms. In the coal industry, ferrous metallurgy, the construction materials industry and a number of other branches, where complicated aggregates and sets of equipment are used, bonuses are awarded to basic workers, as a rule, for fulfillment of production plans by the brigade, shift or shop, and also assignments established for each worker. In order to motivate piece-rate workers to improve the quality of the product (work) bonuses are applied for flawless items and their release with the first demand, for increasing the grade of the product (brand), for reducing rejected work and work that is returned to be done again, and so forth.

Systems of awarding bonuses to time-rate workers for high-quality work, fulfillment of normed assignments and expansion of the service zones have become widespread. In branches where the majority of processes involve equipment, for example, in chemistry and petrochemistry, the workers are awarded bonuses for fulfillment of the production plan or for the observance of technological conditions and parameters when fulfilling production plans.

Numerous conditions and indicators enable the administrations of enterprises to dispose of the bonus part of the earnings of workers (bonuses from the wage fund can reach 40 percent of the wage rate part of the earnings). Therefore maximum utilization of this part of the earnings is usually limited only by the overall amount of the bonus fund which is formed from the wage fund and the material incentive fund.

#### Basic and Auxiliary

The quality of the wage rate system and output norms serve as a condition whereby earnings fulfill their basic functions. Shortcomings in them distort the role of bonuses and increments, which are transformed into guaranteed increments that compensate for the weakness of the wage rate system and the output norms.

An example of an unjustified disparity in the levels of wage rates is when the wage rates of auxiliary workers are lower than those of basic workers. According to calculations, the average monthly earnings of basic workers in industry in 1970, 1975 and 1979 were 151, 187.3 and 212.5 rubles, respectively, and for auxiliary workers--100, 122.2 and 135.9 rubles, respectively. In other words, the average earnings of the basic workers exceeded those of the auxiliary workers approximately 1.5-fold, and the difference is not decreasing, but increasing (from 151 to 156 percent). Let us note that mechanization and automation of production increase the role of the labor of auxiliary workers both in terms of quantity and in terms of their significance in the production process.

The application of new technical equipment industry is of a mass nature and the scope of automation is expanding. There is a predictable increase in the proportion of auxiliary workers who service mechanisms and means of automation, and their skills, the requirements for their general educational level

and the requirements for their special training are also increasing. From 1975 through 1979 the proportion of auxiliary workers in the number of industrial workers increased from 40.56 percent to 42.05 percent. In past decades there has been an increase in the proportion of workers who are paid according to time-rate systems in the developed capitalist countries as well. In the United States the proportion of time-rate workers increased during 1950-1976 from 60 percent to 70 percent.<sup>5</sup>

The increase in the proportion of time-rate workers is an objective process that is brought about by the increased role of personnel who serve the process of production. The attitude toward auxiliary personnel as people who are secondary for the production process and for increased efficiency of the national economy can in no way be justified. An underestimation of the role of service personnel is obviously just as outdated as the idea which lies at the basis of the continuing disparity in the wage conditions for branches of heavy and light industry. The majority of CEMA countries are now correcting their wage-rate systems, and the general direction has been to standardize them and reduce and even completely eliminate differences among them because of the national economic significance of the branches.<sup>6</sup>

The disparity in the earnings of basic and auxiliary workers gives rise to serious problems for managers of enterprises, especially when providing for an adequate level of wages for highly skilled workers, for example, instrument operators, fitter-repair men, and so forth. In order to retain these workers, they usually pay them piece-rate wages, although time-rate payment would undoubtedly be much more suitable here. Frequently working conditions are created whereby it is possible to apply evaluations to hot shops, harmful industries and so forth. The relatively lower level and the excessive rigidity of the wage rate system lead to a situation where these shortcomings are compensated for by bonuses. They lose their role as a stimulus to high-quality work, which the wage rate cannot fulfill.

Bonus systems are utilized more for paying time-rate workers than for piece-rate workers. In industry the bonus systems include about 80-90 percent of the time-rate workers and 60-70 percent of the piece-rate workers.<sup>7</sup>

#### Regulation and the Interest of the Business

Although the increase in wages of auxiliary workers can be centrally regulated more efficiently than for basic workers, in the existing economic mechanism they are still poorly controlled. As distinct from the conditions for the formation of wages for workers, the level of wages for engineering and technical personnel of enterprises, design bureaus and scientific research institutes is strictly limited by normative documents. Branch ministries exercise strict control over their observance and rayon and city financial divisions conduct annual inspections and checks. The list of limitations on wages, the structure and the staffs presented in Table 2 gives a fairly clear reflection of the level of regulation of the wages of workers in these categories.

Small and medium-sized enterprises (which produce less than 10 million rubles' worth of products annually), which in 1975 comprised 84.8 percent of those in industry,<sup>8</sup> in order to have one skilled specialist (designer, technologist or

economist) had to create an entire subdivision (division, bureau or group). Frequently this means that the staff deliberately includes workers for whom there is no work. The structure of small enterprises copies almost completely the structure of large enterprises and associations. Individual subdivisions whose creation does not allow standard structures (a division for preparation for production is allowed only for enterprises of categories I and II) are exceptions. Because of the impossibility of increasing the salaries for highly skilled specialists as a result of the limitations in the salary schedule or the average earnings, the best the manager of the enterprise can do is to introduce an additional management position (deputy head technologist, head engineer or designer). In scientific research institutes and design bureaus this situation is considerably more complex since their management, in addition to the overall limitations of the wage fund, must also maintain particular ratios between the numbers of workers in particular positions and the average amounts of their earnings.

Table 2. List of Limitations on Earnings, Structure and Staffs of Enterprises, Scientific Research Institutes and Design Bureaus

<u>Limiting Indicator</u>	<u>Meaning of Limitation</u>
Monthly earnings	<p>Minimum and maximum amount of salary according to salary schedule.</p> <p>Indicators for including enterprises and shops, scientific research institutes (design bureaus) in wage groups.</p> <p>Policy for establishing personal increments, which determines the list of salaried employees who have the right to them and the amounts of the increments.</p> <p>Policy for the development of staff lists and the establishment of salaries, which envision a correspondence between the sum of salaries according to the staff list and the sum of their average amounts according to the salary schedule.</p>
Structure and staffs	<p>Composition and number of structural subdivisions (divisions, laboratories, sectors, groups) according to standard administrative structures and normatives of numbers of personnel. Composition and number of masters of production sections.</p> <p>Ratios among numbers of workers (1 senior specialist for every 2 specialists; 1 head engineer for every 10 specialists; 1 senior scientific associate for every 2 junior scientific associates; a deputy division chief for every 40 workers.</p>

A widespread situation provides an obvious example. A skilled senior engineer with a salary of 150 rubles has been working in a division laboratory for 5 years. The head of the division thinks that the specialist deserves a salary increase. He knows that otherwise the specialist will go to another organization or enterprise. But the salary for this position cannot be increased (although there is a range of 140-165 rubles) because of limitations on the average salary.

It is impossible to promote him to head engineer (range--170-190 rubles) since the division has 41 people, including 34 specialists, and there are already 3 head engineers (only 1 is permitted for every 10 workers). It is also impossible to separate from the laboratories (there are 3 laboratories with 13 workers each in the division) an individual group and to assign our specialist as its head is also impossible since the group must include no less than 5 people, and the laboratory--no less than 12 people (it would be necessary to eliminate the laboratory).

One can take two paths. The first is to increase the staff of the institute's management by two units and create an individual group, taking one worker from each laboratory. One of the head engineers could be appointed the head of the group and our specialist could be transferred to this position. The second: if the staffs could be increased by 1 unit, an engineer could be hired with a salary of 115 rubles and as a result of the reduction of the "average" the salary of the specialist could be increased by 15 rubles.

Let us also add that the conditions for paying bonuses to workers and engineering and technical personnel are far from the same everywhere. Thus bonuses from the wage fund can be paid to workers if the plan is fulfilled in terms of 1-3 indicators. In a number of cases these bonuses become guaranteed increments. But bonuses for engineering and technical personnel from the material incentive fund depend on a multitude of factors which are determined by the final results of the production and economic activity of the section, shop or plant. The situation is similar with personal increments for engineering and technical personnel. The potentially possible earnings of engineering and technical personnel and masters frequently turn out to be less than those of workers (see, for example, in Table 3), even though the responsibility involved, say, with the position of a master undoubtedly requires higher payment.

One inevitably comes to the conclusion that control over increasing wages with the help of numerous centrally established limitations impedes the growth of the average indicators, but inevitably leads to inadequate effectiveness of the utilization of labor resources. In many cases the number of workers increases, which impedes economizing on the wage fund of the enterprise, scientific research institute or design bureau.

The differing degrees of "strictness" of centralized regulation of earnings of various categories of workers leads to an unjustified deformation of the ratios in the levels of wages. This phenomenon can be appreciable when the growth rates of the production of consumer goods and incomes are high. But a reduction of the rates and the desire to coordinate monetary incomes with the demand for consumer goods, naturally, has a stronger effect on workers with more effectively controlled payment and a lesser effect on those with poorly controlled payment.

Table 3. Potentially Possible Wage Levels of Various Categories of Workers, rubles

Structure of Wages	Laborer (4th category)	Brigade leader (6th category)	Senior master (Plant category II)	Senior master (plant category I)
Wage rate (salary)	108.1	147.5	137.5	147.6
Increment for work in keeping with technically substantiated norms, up to 20%	21.8	29.5	--	--
Additional piece-rate earnings, up to 15%	20	27	--	--
Bonuses from wage fund, up to 40%	60	80	--	--
Bonuses from material incentive fund, up to 40%	30	40	55	59
Total with permanent increments	240	324	192.5	206.5
Increment for combining occupations	54	--	--	--
Personal increment, up to 50%	--	--	40	44
Total potentially possible earnings	298	324	232.5	250

In 1965-1980, despite the increased role of auxiliary workers, the difference in the levels of their earnings (usually time-rate) and those of the basic workers (as a rule, piece-rate) did not decrease, but increased appreciably. The average annual rates of increase in earnings in industry during 1965-1977 were 4.45 percent for piece-rate workers and 3.45 percent for time-rate workers, even though in 1973-1976 the wage rate conditions were revised in favor of time-rate payment for labor.

During 1965-1980 the average annual rates of increase in wages for workers, engineering and technical personnel and employees in industry were 4.1, 2.5 and 3.6 percent. During the 4 years from 1976 through 1980, when no centralized measures were taken to regulate wages, the rates were limited to 2.45, 0.8 and 1.15 percent, respectively. In science and scientific service the average annual rate during this time was 2.65 percent.

One of the key principles in constructing an efficient system of wages in the age of the scientific and technical revolution is higher wages for workers with higher and secondary specialized education, and also for workers holding management positions that involve increased responsibility (that is, engineering and technical personnel) as compared to the wages of workers. But now we are seeing a relative reduction in the level of wages for engineering and technical personnel and workers in science and scientific service. As a result, by the end of the last decade the average wages of basic workers in industry exceeded the level of wages of engineering and technical personnel. The average wages of workers in science and scientific service at the beginning of the decade exceeded the average wages of workers in industry, but remained lower than the earnings of the basic workers. If this difference remains, by the end of the decade the average level of wages for industrial workers will exceed the level of wages for scientific workers.

#### A Closer Link Between Earnings and Results of Labor

In order to surmount the negative phenomena related to the deformation of the ratios in the levels of wages, one should achieve equal "strictness" in the regulation of the wages of various categories of workers. This is possible either as a result of increasing centralized control over the wages of workers, especially piece-rate workers, or as a result of increasing the independence of managers of enterprises and institutions in the utilization of the wage fund.

In L. I. Brezhnev's report at the 26th Party Congress it was determined that improvement of economic administration at the level of associations and enterprises will proceed along the path of increasing the independence of associations and enterprises as well as the rights and responsibilities of managers. The way this will be implemented in practice is shown in the decree of the CPSU Central Committee and the USSR Council of Ministers of 12 July 1979.

The planning of the wage fund is being improved: it is being determined by stable normatives of wages per ruble of normative net output. Its substantiation will be considerably increased and there will be a stronger link with the results of production. Consequently, it will be possible to reduce a number of limitations on the independence of the enterprises and associations in the utilization of the fund, and some of these limitations will be removed completely since this planning indicator will become the main guarantee of the substantiation for increasing wages. For if the expansion of the wage fund is possible only as a result of increasing the collective's contribution to the national income, from the economic standpoint an increase in wages within the limits of this fund should be considered justified. And in distributing the fund within the collective a decisive role should be played by the collective itself and the management of the enterprise. The manager is interested in effective distribution of the money from the wage fund among the workers just as he is interested in fulfilling production assignments. Only in this case will the workers be motivated to improve the results of labor.

Unfortunately, it is precisely the point in the decree concerning normative determination of the wage fund that is being implemented poorly. In practice, in cases of failure to fulfill the plan or decreased effectiveness of production, the wage fund of the enterprise is not decreased since the reasons are usually

sought in the poor operation of related industries. Therefore even enterprises that have appreciably increased labor productivity have to "cut" their growth of average wages. The wage fund is formed as a rule, by the traditional method, and the normative per ruble of output is established on the basis of this calculation and the output plan. An effective link between wages and the results of labor can be provided only by normatives that are unified in terms of groups of branches or at least in terms of representative groups of the same kinds of enterprises and are established for the five-year plan.

We are now lacking not only unified or branch values of normatives, but even group values. Practically every enterprise has its own normative. As early as 2 months after the publication of the decree there was an explanation that granted the ministries the right to differentiate normatives for the various enterprises. Of course this is not a matter of the "evil will" of the Gosplan or the ministries. The introduction of unified or branch normatives is hardly possible without a simultaneous improvement in a number of other systems of economic control.

Various kinds of positive experience in the regulation and utilization of the wage fund by the enterprises has been accumulated in the sister socialist countries. As was already noted, a number of countries have standardized wage rate systems and introduced ranges of wages for each category. The managers of associations and enterprises have, as a rule, a considerable amount of freedom in distributing the wage fund, right down to the opportunity to select between utilizing the increase in the wage fund for increasing the number of workers or raising the level of payment for those who are employed.<sup>9</sup>

Constant attention and study should be given to the experience of the CEMA countries in changing the sources of financing for measures related to the changeover to new wage rate conditions and increasing rates of earnings.<sup>10</sup>

Additionally (up to the beginning of the 1970's), these measures were conducted during the course of mass one-time revisions of wage rate conditions and mainly through the state budget. Now the basic source of financing will be the internal funds of the associations (enterprises).

Centrally developed wage rate conditions are introduced as they are ready at enterprises and economic organizations that have guaranteed funds for financing wages according to the new rules. This means complete realization of the principle according to which wages must be earned beforehand, while the previous method meant advancing them for results that have not been achieved yet. The application of the new method stimulates improvement of labor norms and makes it possible to modernize jobs, to regroup workers and to reduce excess personnel. Now the time periods for increasing the basic wages in the collective depend on the results of these measures.

#### Dynamics of Wages and Price Setting

One should be aware of the difficulties involved in providing for proportionality in the wages of various categories of workers when the collectives and associations have more independence. The rates of economic growth decrease since the

observance of proportionality presupposes orienting the wages toward those categories of workers for which they are poorly controlled and, consequently, for which they increase more rapidly.

There is reason to assume that there exists a certain lower limit of rates of increase in wages. Artificially reducing them below this limit can lead to a violation of the stimulating function of the system of wages.

This is probably determined by the "natural" growth of the average wages of workers, which, because of the tense balance of labor resources, becomes poorly controlled.

Throughout the 20 years of 1960-1980 the average annual rate of increase in wages for industrial workers was recouped by up to 2.3-2.4 percent only in 1962-1964 and 1977-1979 when centralized measures were not taken for increasing wages. In favor of the 2.4 percent, as a rate of "natural" growth of wages for piece-rate workers, one can use a rough estimate. The average weighted skill category increases approximately 3 percent per year. With an average category of 3 or 4, this increase per unit takes place within 8-10 years. The average category coefficient in the existing six-category system ranges around 1.1. As a result of the higher average category the wage rate part of the earnings, consequently, increased annually by 1-1.2 percent, while the overall level increased by 0.8-0.9 percent.

In 1960-1980 the overfulfillment of the output norms during the periods between the revisions of the wage rate conditions led to an increase in wages averaging 0.5 percent per year, and an increase in the bonus part--of 0.1-0.2 percent. Such characteristics of "natural" growth of wages of piece-rate workers provide an estimate of this rate of 2.3-2.5 percent annually.

One should additionally keep in mind the regularly arising need for centralized measures to increase the wages of workers and employees in industry at least by 0.7-0.8 percent annually. In order to overcome the disproportions in wages, the funds for centralized measures should be distributed as uniformly as possible among laborers and other categories of workers, and among branches of material and nonmaterial production, and the growth rate of the average wages should not drop below 3-3.2 percent per year. The lower limits of the wage rate should be ensured even while retaining the existing proportions with the "natural" rapidity of growth of wages of piece-rate workers in the sphere of material production. A stronger link between wages and results of labor requires much higher growth rates of wages.

The existance of a lower limit of increase in wages is not limited, obviously, to industry alone. Similar arguments can justifiably apply to other branches of the national economy as well.

With high rates of economic growth and production of consumer goods, the minimum limit does not upset the national economic proportions. And with low rates, the wage increase even at the level of the minimum can become one of the factors in the lack of balance of income of the population and their material coverage as well as consumer supply and demand. But this should not be an argument for limiting the growth of wages, which involves a violation of

the stimulating functions. The socialist state has a large arsenal of means to deal with the lack of balance: from payment of above-normative goods and services (the introduction of additional payments for surplus dwelling space and so forth)<sup>11</sup> to an active policy regarding retail prices.

The increase in wages is far from the only factor in the mobility of the overall price level, as is frequently thought. As A. I. Komin notes, "Price stability cannot be regarded as a general freezing of prices. A change in production and sales conditions under the influence of changes that are taking place in the needs and demand of the population leads to a gradual outdatedness of prices for individual goods and even entire price lists."<sup>12</sup>

Balance in the national economy and satisfaction of the demand were named at the 26th Party Congress as primary tasks in economic development. One of the main instruments for balance is prices. Price-setting as an element of national economic planning and the formation of a dynamic of prices that coordinates production and consumption constitute a large reserve for effectiveness both in the sphere of production and in the sphere of consumption. The extreme inertia of the price system can lead to a situation where it stops being an instrument for balancing supply and demand and making intelligent economic decisions. Therefore the problem consists in selecting those methods of regulating the overall price levels which will not impede their fulfillment of these most important functions<sup>13</sup>.

It can be very important when providing for balance to restructure national economic planning in keeping with the principle "from income to consumption,"<sup>14</sup> when the indicators of the income of the population and their differentiation are given as initial ones, and others are coordinated with them. But a consideration of the issues that rise here goes far beyond the scope of this article.

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## NEW APPROACH TO CHILD REARING, FAMILY SERVICES NEEDED

Novosibirsk EKO: EKONOMIKA I ORGANIZATSIYA PROMYSHLENNOGO PROIZVODSTVA in Russian No 10, Oct 82 (signed to press 26 August 1982) pp 149-170

Article by Yu. B. Ryurikov (Moscow): "A Family Matter? No, a State Matter!"

Text Since the 26th CPSU Congress we have begun to change over to systematic and balanced development of all parts of the society--not only production, administrative and social relations, but also the socio-domestic infrastructure, families and education. Immense reserves for eliminating many social disproportions lie precisely here.

In the family and in education there is a process of "spiritual production"--the formation of man as the main bearer of social relations and the main unit of productive forces. The entire course of social progress depends largely on the success of this process.

Family life and the education of children are two immense, interdependent areas of the social organism, but their level, unfortunately, still lags behind the demands of a developed socialist society. The elimination of this difference can lead to a general upsurge both of productive forces and of social relations.

Man is in the sphere of production. And his attitude toward labor and his comrades at work--these qualities do not appear of their own accord. Man is formed by everything: his immediate environment, empty rumors, the behavior of his seniors, the position of his contemporaries, school, VUZ, books and films. But the roots of character and the features of the personality go back, as a rule, to the family. So we come to an understanding of the most important role of the family in the life of the society: This is precisely what largely determines the quality of being human. Therefore it is quite impossible to evaluate that assistance which the party and the state render to the family in the matter of educating the younger generation.

We have asked a well-known Soviet sociologist and writer, Yuriy Ryurikov, to share his ideas about the role of the family and problems he sees in this area of social life.

In the educational influences of life there are, schematically speaking, two branches: education by the environment--spontaneous education by life itself, the very system of daily relations in which people live; and education proper--a deliberate process. The system of educating influences arises at the juncture of these branches--as their resultant force. And in order to improve education it is necessary to improve both the spontaneously educating environment (especially the family environment) and deliberate education.

In the second half of our century there have been immense changes in the entire lifestyle of the family, in the entire way of life. Urbanization, the scientific and technical revolution, the changeover from the old family consisting of two generations to the present small family--all these progressive processes not only bring favorable changes, but, as is usually the case in history, give rise to new contradictions. Fortunately, specialists in the family and education speak more about the positive aspects of the scientific and technical revolution, urbanization and the small family than they do about the less clear-cut aspects. But only a complete grasp of all the motive forces and brakes of progress will make it possible to understand them as a system and to strengthen the pluses and ease the minuses of progress.

Our country's achievements in solving the problem of women, in maternity and child-rearing assistance and in education are known throughout the world. We have done and are doing many things for the first time in the world; and many things relating to women, the family and children have been truly social discoveries. Especially important here is the society's constant assistance to the family--a completely new feature in the relations between the family and the society which did not exist in history before this.

Kindergartens, day nurseries, extended day groups and schools, children's sanitoriums, pioneer camps, medical consultations for women and children, paid vacations for childbirth, stipends for mothers with many children and for families with small incomes per member--all these measures have a positive influence on the life of the family, but recently their efficiency factor has decreased appreciably. In the article we shall speak about the reasons for this decrease and about a system of measures which can improve the life of the family and the education of children. The subject of the article is not an overall picture of family life, but only part of this picture--the minuses in the family situation and the ways of eliminating them which are being suggested by representatives of the most varied sciences--sociology, economics, demography, psychology, physiology, sexology, medicine, pedagogy and ethics. Some of these measures were advanced long ago by family experts, and we are only now becoming aware of some of them.

#### In A Web of Contradictions

During the second half of our century in the family, in daily life, in education and in the entire urban lifestyle an unprecedented system of contradictions has arisen--both new ones, which have just originated, and old ones which have

become more critical. In order to fight against them it is necessary to understand this system and to see its main variables.

The "sedentary civilization," the information explosion and the ever accelerating rhythm of life bring about a sharp decline in people's physical exertion and the same degree of sharp increase in their nervous and mental exertion. Physical underloading is combined with nervous overloading and these new socio-biological scissors increasingly threaten the health of people and the condition of all systems of the organism--nervous, hormonal, cardiovascular, and so forth.

Figures confirm the seriousness of the problem. World statistics show that many pregnancies proceed with deviations from the norm. Because of this in large cities about 90 percent of the newborn children (a 3-4-fold increase since the war) are born physiologically underdeveloped, that is, with some underdeveloped or weak internal organs or systems of the organism. Physiologically underdeveloped children subsequently join the ever increasing contingent of individuals suffering from the major diseases of the century--nervous, cardiovascular and pulmonary.\*

The extreme drop in the birth rate in cities leads to entire generations of people who are the only child. Their very position in the family causes excessive attention to them on the part of adults and, as a result, they pay excessive attention to themselves, and this leads to self-centeredness and egoism.

The sharp increase in families with conflicts and crises has a bad influence on rearing. During the last third of the century the number of divorces increased approximately 15-fold, amounting to 950,000 in 1979. During the past decade the number of divorces has increased each year by 35,000-40,000 while the number of marriages has almost not changed. Moreover, private marital quarrels poison the atmosphere (according to various data) in one-half to three-fourths of the urban families.

The difficult material and living conditions of many young families have an appreciable influence on the rearing and health of children. The majority of young wives who have been married do not have their own apartment. With the birth of a child, when the mother stops working for a year, the income per individual in the family drops to one-half-one-third the previous level. In combination with the overloading of young mothers, the shortcomings in the operation of kindergartens and day nurseries, and the high rate of illness of children, all this increases the tension of the atmosphere in young families and frequently leads to their breakup.

According to data of sociological and demographic research, most of the divorces are in young families: here the average duration of a marriage that is breaking up is 5.5 years.

Recently the average age of newlyweds has dropped, and, according to demographic predictions, will drop even more. And the younger they are the less ready they are for family life--materially, morally and as parents. This means that in the near future there will be even more families with a weak foundation.

\*NAUKA I ZHIZN', 1982, No 2, p 74.

From the social standpoint the young family is a special category of families. It is more flexible than other families, more prepared for changes, and it absorbs new tendencies more rapidly, but it also has the weakest foundations (except for the foundation of feelings). Being an advanced model of the family, it will serve as a favorable point for the application of efforts since it can produce the most rapid response to assistance. It is obviously necessary to take this special role into account when developing the demographic policy.

The majority of urban families have no labor education. In the old peasant handicraft family young children participated in productive labor and housework, and with all the minuses of this labor (excessive workloads, stupifying monotony) it included a clearly healthy kernel, which instilled healthy human qualities in children--both moral and business. In the present urban family there is neither productive labor nor an educational labor atmosphere. The children do not see the labor life of their parents and moreover they practically do not participate in housework or assist their parents, and this instills a consumer orientation in them.

One of the most serious changes which urbanization is bringing to the modern way of life is a weakening of social ties to daily life. Along with the dying out of communal life and the breaking up of 3-generation families into small families, the daily mutual assistance within families is also coming to an end. Mutual assistance among neighbors is also dying out in the cities: In the majority of cities 80-90 percent of the neighbors either do not know one another at all or limit themselves to superficial contacts. Our life is divided into tens of millions of small groups which are almost not related to one another in their activity and almost do not assist one another. The present-day urban family leads a closed individual way of life more and more. It does little to instill in people the spirit of collectivity and fraternal mutual assistance and, on the contrary, cultivates individualistic positions.

The overloading of women and their double working day has a harmful effect on the spiritual atmosphere of the family and the rearing of children. These factors sharply reduce the mother's real ability to engage in child rearing and deprive them of the time and energy necessary for serious parenting. Many mothers lose their taste for child rearing, reduce their material role to serving the children, and narrow maternal labor--which is basically spiritual--to strictly physical labor.

The poor development of consumer services, which was sharply criticized at the 25th and 26th CPSU Congresses, also contributes to this. These services, as research of Gosplan economists show, now provides for only one-thirtieth of household labor.

The shortage of kindergartens and day nurseries and the poor quality of their educational work impede the improvement of child rearing. About 15 million children in the country go to kindergartens and day nurseries. This is an immense figure, but it accounts for only half of the preschool children. Educational work in kindergartens and day nurseries is arranged on archaic bases which underestimate the possibilities of early childhood and almost do not take into account the major discoveries in child physiology and psychology.

The poor participation of the majority of fathers in child rearing is also harmful to the children. For correct psychological development of children it is necessary to have a balance of male and female influences. In the old family the children were influenced not only by the father, but also by the grandfather, uncle and brother-in-law. In the present small family the only remaining source of male influence is the father, and even he has little influence on the children. There are no men at all in the kindergartens and day nurseries, almost none of them in the primary school, and clearly not enough of them (two-tenths-three-tenths of the teachers) in the secondary school. All of childhood--a decisive stage in the establishment of the personality--now takes place under the aegis of matriarchy, in an atmosphere where feminine influences sharply predominate.

Male influence on children is now growing into a large socio-psychological problem; the inadequacy of this influence largely gives rise to mass feminization of boys and male adolescents, and leads to a situation wherein when they become adults they do not acquire male strength and responsibility with respect to themselves or to their family roles.

The excess of feminine influences leads to a situation where many girls do not form a stable ideal and anti-ideal of the male, the basis of which, according to data of psychologists, arises primarily in the family, from daily contact with the father. This dooms many girls to an incorrect choice in the world of love life.

Separation of adults and children in daily leisure, beginning with adolescence, also impedes education. Children in secondary schools and senior classes are separated from their parents and receive less and less of their influence. Children of various ages are also separated from one another, especially in schools. "Peer" communication is becoming predominant and this appreciably reduces the spiritual exchange among various generations and various groups of children.

The old circles of daily communication which joins people of various generations together are dying out. In life and leisure younger age groups have been separated from older ones. The result of this is child neglect. The influence of the streets, that is, youth groups, frequently becomes the main educational influence for adolescents. In many cases it has a distorting effect on the moral development of adolescents, especially on their sexual morality.

We have no sexual education at all--either in the family or in the school. Sex education has been separated from formal education and is provided on a pre-scientific level, most frequently in the spirit of a simplistic, conservative dialectic. In the school there is no preparation for family life: almost no educational literature is published for adolescents and youth, and the majority of the teachers and parents themselves are in the captivity of sexual illiteracy. Therefore the main educator and rearer of youth is not the family and not the school, but the street. This poisons the minds of millions of children with half-truths and contributes to increased sexual egoism and sexual experience when they are much too young.

Not only do we not have sexual education, but we do not have family education as a system either, and people are not prepared in any widespread way for family roles. Therefore the majority of parents suffer from illiteracy about child raising--ignorance of the peculiarities of child psychology and its essential differences from adult psychology, and the inability to rear children in terms of their special psychology and physiology.

In the age of the information explosion and the ever increasingly fragmented division of labor, family rearing becomes much more complicated. The demands on it increase sharply and now it is simply impossible to carry it out without special preparation, which should include the major achievements in child physiology, psychology and pedagogy. Child rearing under present conditions should become a kind of new general occupation, and in order for it to be performed well, it should be carried out precisely on a professional level.

Child rearing is also complicated by the two-fold changes in the psychological nature of modern man. Overloading because of the accelerated rhythm of life and the less clear aspects of urbanization lead to weakening and standardization of our feelings. On the one hand, people's feelings and awareness are individualized, and there are more and more developed personalities, people with complicated psyches.

The sharp changes that are taking place in people also sharply reshape the fabric of their psychological relations. But the awareness of these changes lag behind their rapid course, and we frequently relate to children "from a generation ago," unable to cope with their new image--and therefore we cannot rear them purposively, taking into account their new pluses and minuses.

One of the main subjective impediments which reduces the efficiency factor of education is an incorrect understanding on the part of parents and pedagogues of the role of early childhood, and hence the not very effective system of home and preschool education of children up to 5-6 years of age, which does not correspond to the child's nature.

As psychologists and physiologists have established, early childhood is a unique age in the development of man, and it plays a decisive role in the formation of basic, including labor, qualities of the personality. It is precisely in the first years of childhood--and precisely in the family--that the psychological core of the child's personality, his essential foundation, is created. It is precisely at preschool age that the most long-lasting properties of the human psyche are formed, its deep nucleus, the primary foundations of the emotional and moral attitude toward life. Other influences of life will be superimposed upon them later, but the reception of these influences and the degree to which they are transformed into motive forces of behavior--all this will depend basically on the primary foundations of the personality which are laid in early childhood in the family.

But early childhood (and family rearing of preschool children as well) stands outside the focus of the attention of psychology and pedagogy. In complete lack of correspondence with the importance of this age, pedagogues of preschool institutions receive the least education. Moreover, educators in kindergartens simply do not have the capability of rearing children with an individual approach,

since each of them is in charge of 30-35 children. Preschool education is poorly paid, and people who have no pedagogical abilities frequently go there.

One of the main sources of many of these unclear phenomena is an underestimation of the most important social role of the family on the part of science and, as a result, on the part of administrative agencies.

The family is one of the most important units of society (along with the labor and social collective). It gives society no less than other units give, and social progress depends on the family no less than it does on them. The family has four main functions, four main social roles. First, demographic: The family is the demographic foundation of the society, the only source of those human forces of which the society consists. Second, economic: The family is the main unit for restoring forces expended in labor and it serves as one of the main supports for the society's labor potential. Third, educational: The family is the main educational unit of the society, and the morality, humanity and awareness of all of us, the people of which the society consists, depend no less on it than on other units.

Finally, the family is the main psychological unit of all the groups of humans. It has a unique psychological foundation which the other human units do not have. A normal good family is arranged on a union of three loves--of the husband and wife, of the parent and of the child. At the basis of each of these feelings lies the ability to value loved ones as oneself, their interests as ones own. And an attitude toward another as toward oneself is an elementary part of humanism, a brick in its foundation. Therefore a family--a normal, good family --can be a powerful generator of humanism. In every day existence and in personal life it gives people that which is given to society by high ideals and high principles of social structure that have been developed by mankind. Herein lies the unique socio-psychological role of the family--for the society and progress.

Unfortunately, many families now fulfill their role as the "nest of humanism" poorly, they do a poor job of coping with their demographic, economic, educational and psychological role. We do not have a system for social control of the development of the family, and it preceeds largely spontaneously, almost without regulation of its pluses and minuses. The material-financial, socio-demographic, educational and organizational assistance to the family is inadequate, and this makes the contradictions of the family and child rearing more burdensome.

#### The Strategy of Universal Assistance

As we see, in the family, in daily life and in education the ramified system of harmful phenomena has increased recently. It is possible to neutralize these phenomena, perhaps, only with a system of countermeasures--just as ramified and all-embracing. As life shows, new problems cannot be solved by old methods. Partial assistance to the family and education can apparently produce only partial improvement. Only by acting simultaneously--systematically--on all the sources of those less positive phenomena is it possible to disarm them.

Unfortunately, science (sociology, economics, demography, psychology, sexology and pedagogy) have formed neither a strategy for the development of the family nor a strategy for education. We do not even have a working model of today's and tomorrow's development of the family and education. Science has not established the strongest or the weakest places in this development, those for which assistance should be given first, second and third . . . .

V. I. Lenin spoke sharply against such a lack of attention to strategy: "A person who deals with individual issues without first resolving common ones will inevitably, unknown to himself, 'stumble' over these general issues at every step. And to stumble blindly over them in each particular case means to doom one's policy to the worst vacillation . . . ."

In a discussion which took place before the 26th CPSU Congress, important suggestions were made concerning the development of a family and educational strategy. It was suggested that a special-purpose program be created for consolidating the family and that it be based on a new strategy of family assistance--universal systematic assistance which would affect all aspects of family life. This would mean, obviously, assistance in maintaining the home, educating the children and family recreation, and housing, financial, health, educational, cultural and organizational assistance. One should apparently pay special attention to assistance to the young family--the working, rural and student families; especially assistance to the broken family, the family without a father and the family of the veteran.

Important measures were earmarked in the decree of the CPSU Central Committee and the USSR Council of Ministers concerning assistance to the family (1981) and in the Basic Directions for the Economic and Social Development of the USSR During 1981-1985 and the Period Up To 1990. These documents raise an active demographic policy to the rank of a state policy, and at its center is assistance to the family. There will be a paid annual maternity leave, part time work and housework will be introduced for women, young families will receive housing privileges, stipends for single mothers will be increased, and so forth. Of course this is only the first step along the new road, but it is a principally important step--it opens up the new road.

The system of measures required here should apparently be of a tactical-strategic nature and consist of a minimum program and a maximum program. The minimum program should probably be arranged on the basis of two factors: the main goals of communist construction ("the highest stage of development is the key to the lowest stage") and the possibilities of the present day, the relative effectiveness of the labor-intensiveness of the proposed measures.

#### Socio-Economic and Demographic Measures

First of all we need accelerated restructuring of housework, which is based on manual labor, into a publicly mechanized endeavor. The long-range strategic goal of this restructuring is to prepare material conditions for a historically new kind of family, for transforming the family from an economic unit into a unit of kinship, love and education.

According to data of economists, more working time now goes for heavy and unskilled work in the home (including the subsidiary farm) than is expended on all public labor: on household labor--275 billion man-hours a year, and on public labor--240-250 billion.\* Herein lies one of the largest disproportions in all of the development of our society, one of the main impediments to the development of the family.

In order for the assistance to the family from consumer services to be really appreciable, it would be necessary to increase the volume of their work by a minimum of 10-15-fold, that is, to increase it from 8.5 billion rubles (the present level) to 85-120 billion rubles. Then the consumer services would perform not one-thirtieth of the housework, but one-third or one-half. The same thing pertains to the network of preschool institutions: we should at least double its capacity, to accommodate 28-30 million in order for it to include not half, but all of the children.

During the next five years consumer services are to increase almost 1.5-fold, and the preschool network--by almost one-fourth. This is quite a bit. But calculations show that with this growth rate the liberation of the family from overloading could take several decades. The solution probably lies in augmenting state efforts with social ones: creating household unions of families, especially young ones, and also home (cooperative) consumer services, and small home kindergartens, day nurseries and groups (of course, on a strictly voluntary basis). Sociologists have been suggesting this for a long time.

Such household and educational unions could provide a three-fold advantage: First, they would reduce the household overloading of the family by one-third; second, they would improve child education because the children would no longer be "only children" and, moreover, the fathers would have much more time for them; and, third, the unions of families would strengthen the principle of community and fraternal mutual assistance in daily life and would neutralize that dispersion of lives which is to be found in today's small family.

The combination of social and state factors is probably the most rapid and most reliable method of improving life today. Of course, this is double-edged, and even with the most cautious utilization of it it is hardly possible to avoid bad consequences. But its pluses will apparently be appreciably greater than its minuses, and even the minuses themselves will be much less than the minuses of the present fragmented household and the isolated raising of "only children."

During the 1960's a successful experiment in domestic cooperation was conducted in Kiev: About 3 percent of the Kievans participated in joint education of children and also in mutual household assistance, and a total of 17 percent were ready for this kind of collective assistance. An experiment like this is now in progress in Kaliningrad near Moscow. Thousands of families of young engineering and technical personnel, workers, employees and scientific workers are participating in it. They live in a youth housing complex which they constructed themselves. Their experiment was recognized

\*Mushkina, Ye., Ryurikov, Yu., et. al., "Strength to the Family," PRAVDA, 4 February 1981.

with a prize of the Leninist Komsomol, but, unfortunately, it has not been extended to other areas.

It is apparently necessary to have extensively developed experiments in creating economic unions of young families and home (group) kindergartens and day nurseries. From one-third to one-half of the city dwellers who were questioned are now in favor of these unions--especially for educating and caring for children.

It would be very important for the Komsomol to handle these household unions. In 1979 the Komsomol Central Committee at its 5th Plenum called upon the Komsomol to sharply increase the assistance to the young family but, unfortunately, so far little has been done.

A complex of socio-demographic measures to assist the family can play an important role; many of them have already undergone many years of testing in Czechoslovakia, Hungary, the GDR and Bulgaria, and have proved their effectiveness.

First of all, this means increased paid maternity leave: maternity leave--minimum up to a half year (now--four months); and educational (with pay equal to or close to earnings)--minimum up to two years. By a decree of the CPSU Central Committee and the USSR Council of Ministers concerning the family, in 1981-1983 partial payment for annual vacation will be introduced: 50 rubles a month in Siberia, the North and the Far East, and 35 rubles in the other zones of the country. Later, apparently, the time periods for paid vacation and the amounts of the payments will increase.

In addition to state expenditures for these purposes, it would be possible here, following the example of Estonian enterprises (the fishing kolkhoz imeni S. M. Kirov, the Tallinn poultry farm and so forth) to recommend that enterprises pay young mothers for child-rearing leave out of their own funds, including this assistance (along with educational leave) in the plan for the social development of the collective. In general, assistance from the enterprises to the family (financial, housing, domestic-personal) is an exceptionally important and new path to social reforms, which is gradually originating in the Urals, the Ukraine and in other places.

Following the example of the CEMA countries it would apparently be worthwhile to introduce a new system of stipends for the child as well. The old one was largely established more than 30 years ago, under the conditions of a quite different socio-demographic situation and it has lost its meaning; stipends for children are inadequate and only a small proportion of the parents receive them (mainly those with many children).

Now--and sociologists, demographers and economists agree on this--it is necessary, first, to pay one-time stipends for mothers with the first, and not the third child (the decree concerning the family introduces these stipends); second, to pay monthly stipends for child rearing leave whose amounts are more for the second child than for the first as well as for the third (and, perhaps, the fourth), but for subsequent children the stipends decrease. Thus the society would give most assistance to the family with three children which, in

the opinion of scholars, is closest to optimal. Partial payment of annual vacation, as was already said, is being introduced in 1981-1983, but the sequence of payment will apparently appear in the future.

For working mothers, as is the case in Czechoslovakia, it is apparently necessary to have increments to wages which increase with each child up to the third and then decrease. It is also necessary to increase vacation in proportion to the number of children and extensively introduce part time work (without reducing wages, as is the case in the GDR). The decree concerning the family increases the leave by 3 days for mother with 2 and more children under 12 years of age, and also makes it compulsory to extensively introduce partial working days and reduced work weeks for women.

The creation of a special industry for child nutrition and also a special service for caring for children in the home would reduce the parents' concerns a great deal. Such a service could deliver clean diapers and children's food, rent and repair children's future and equipment, and so forth.

A system of assistance to young families can play a cardinal role:

preferential credit for entering housing construction collectives or for building a home (this is partly stipulated in the decree on the family); the construction (following Kiev's example) of buildings for young married couples and young families; when distributing housing giving special attention to the socio-demographic role of the young family (this is also stipulated in the decree). Such measures have recommended themselves well in the CEMA countries;

expanded construction of family dormitories and workers' and student dormitories with day nurseries and kindergartens as part of them;

the creation of young family clubs and courses for young parents everywhere;

the creation of voluntary domestic unions of young families.

It is exceptionally important to provide assistance for the rural family and the family that has a subsidiary farm (this means half of all the families in the country--about 30 million):

the construction of individual rural buildings with urban conveniences;

a sharp rise in consumer services in rural areas, including cooperative service through the efforts of kolkhozes and sovkhozes, and also the creation of independent child rearing groups and domestic household unions;

the creation of small-scale technical equipment for subsidiary farming.

It goes without saying that we need permanent development of current and long-range measures for assisting the family: this is the scientific foundation for the deliberate regulation of spontaneous socio-demographic processes. In order to develop and renew this foundation, we will need scientific associations

which investigate the family systematically, from the standpoints of various sciences and, above all, a comprehensive family institute under the USSR Academy of Sciences, and also special magazines about the family--both scientific and scientific-popular.

#### Socio-Pedagogical, Health and Educational Measures

Life itself is now generating--in science, daily existence and pedagogical practice--means which can reduce many of the minuses in the development and rearing of children.

**Health Measures.** Age-group physiology has revealed, first, methods of prevention which reduce the harmful influence of the environment on the organism of the pregnant woman and the child; second, methods which make it possible to prevent the majority of health violations for physiologically underdeveloped children and to lessen the deviations from the norm, including moderate congenital retardation.

The introduction of principles of age-group physiology can produce an immense social effect: they make it possible to counteract the main bad aspects of present day urban life--chronic nervous overloading and physical underloading. It is apparently necessary to have a practical program which would envision (for the various years and five-year plans) how the discoveries of age-group physiology will be introduced, how specialists will be trained and how aids will be produced for them.

No less important is a working program for creating throughout the country a network of psychological, sexological and medical-genetic consultations which would consult with parents and spouses regarding all issues of family life, would predict the compatibility of people and the health of their offspring, and would handle prevention and treatment of sexological and hereditary disturbances.

#### A New System of Child Rearing

Recently in life itself a radically new system of child rearing has appeared which will apparently become the main kind of rearing in the future.

This is a system of early multifaceted development which the Nikitin (Moscow area) family has been practicing for almost a quarter of a century. Its essence lies in early formation of all the main capabilities of man--physical, emotional, moral, volitional, mental and aesthetic.

Experience in early development (here and abroad) has shown that these capabilities are best in early childhood, when the brain is exceptionally resilient. It has been established that the development of capabilities exceeds best when they grow simultaneously and in various ways, reinforcing one another. Thus the new rearing experience is a two-fold discovery in human nature: first, the best age and, second, the best method of man's development. For the first time in history there has appeared a child rearing system which reflects precisely the child's nature and the foundations of child physiology and psychology.

What does the strategic social role of early all-around development consist of? It gives rise to creative capabilities in people and creates a type of creative man who can become the main kind of worker in the flourishing of the scientific and technical revolution. A shortage of such workers impedes many aspects of progress, and early all-around development is today the only and the most effective method of rearing on a large scale a worker-creator who is developed in all ways and free of the current one-sided specialization.

Thus early all-around development is a historic factor of dual force. It can become a new medication against new diseases of time--such as nervous and mental overloading and physical underloading. It can become one of the main factors in solving the central problem of communist construction--mass rearing of an all-around man-creator. This is apparently the first known embodiment of one of the major ideals of Marxism--the birth of a historically new type of individual. It is possible that this is the most practical bridge to the future which life itself engendered.

Because of the unprecedented social importance of the new system of child rearing, it requires comprehensive study which is as profound and as immediate as possible. To do this, in my opinion, it would be worthwhile:

to create a comprehensive interdepartmental laboratory of the USSR Academy of Sciences, the Academy of Medical Sciences and the Academy of Pedagogical Sciences for studying early all-around development (possibly it could become the nucleus of a future institute);

to conduct a broad scientific experiment: all-around formation of capabilities in kindergartens and day nurseries--with the experiment to be continued in the school;

to arrange mass publication of literature concerning early all-around development, primarily books by the Nikitins themselves, including the scientific-theoretical work of B. P. Nikitin, "The Hypothesis of the Appearance and Development of Creative Capabilities"; to prepare methodological aids for educators in kindergartens and day nurseries, for teachers of junior classes and for parents;

to organize wide-scale industrial output of the "development games" of the Nikitins and the "home stadium" of engineer V. S. Skripalev;

to prepare for pedagogical VUZ's and schools a course entitled "Early All-Around Development."

The strategic goal of all these measures is gradual and cautious transformation of early all-around development into the major system of education in children's institutions and in the family, without equal sharing, and with more rapid training of personnel and in-depth education of the parents.

#### A Sharp Rise in the Prestige and Quality of Pre-school Education

Taking into account the unique nature of early childhood and its decisive role in laying the primary foundations of the personality, we need a truly scientific

system of early education. It would be worthwhile to organize a special interdepartmental scientific group consisting of specialists in the physiology and psychology of early childhood, pedagogues of various profiles, family sociologists and practitioners who would create a comprehensive program and methods for this education and would draw up recommendations for its practical introduction and for the training of child rearing specialists and educators in this area.

The maximum program in the area of early education should become one of the main pedagogical concerns of the society and science, that is, it should be brought into line with its actual significance.

To do this it will apparently be necessary to significantly raise the general educational level, prestige and payments for workers in preschool institutions, to develop a system of benefits for them, and to sharply improve their occupational selection and training. It is very important, moreover, for the occupation of educators in preschool institutions to cease to be a feminine occupation and for it to enlist more and more men.

We also need "family general education"--a broad system of training of youth for family life, beginning with the school desk, and above all a special subject called "family life" in the schools, tekhniums, vocational and technical schools and VUZ's. The decree concerning the family envisions the introduction of this subject in the next few years and also the publication of educational literature concerning various aspects of family life. It is also necessary to educate young married couples and parents along all the main lines of family culture: psychological and sexological culture of marriage, educational culture of parents, and home economics.

The labor education of children should apparently begin as early as possible: at the age of one and a half or two years they can do the simplest household chores along with older people. Early inculcation of the need for housework and to help older people is an exceptionally important foundation for moral development.

Of course, present day housework, in the narrow circle of the small family, cannot be a full-value basis for labor education. Joint labor in unions of families could perhaps be much more effective--labor in a broad group of communication, collective labor with other children and adults. The educational influence of this kind of labor should be much greater.

The rise of the male role in the family. In "communal" family unions it will be easier for young families to acquire household appliances, and men will constantly be turning to one another for help and to share experience. Under these conditions it is easier to enlist men into the two main family matters in which they do not participate enough--household work and rearing of children. This will improve the entire family climate, will improve child rearing and will reduce the overloading of women.

One of the main factors in increasing the educational potential of life is restructuring school education and training. It can open up an entire matrix of new social reserves for improving the society's entire life.

The strategic line of this restructuring is a changeover from the assimilation of knowledge as the main practical goal of training to the development of creative capabilities, from partial and irregular development of various aspects of the individual to uniform and comprehensive development of the individual--physical, moral, volitional, mental and aesthetic.

Such restructuring will obviously proceed in several directions. Training will be combined, as it is envisioned by the founders of Marxism, with real productive labor that is interesting to children (1-2 hours a day) and with regular classes in physical culture and sports. Game training methods will be extensively used in junior classes. Methods of rote memorization will be replaced by the method of situation-role games, in which the coefficient factor is 2-2.5 times greater. Instead of impersonal measures of success--grades--there will be personal "measures of development": they will measure not the degree of assimilation of knowledge but the most varied aspects of the development of the most varied human capabilities. The teaching of one subject or another will be changed from the transmission of a sum of knowledge into the development in school children of those capabilities which generate this subject. Thus teaching will merge organically with education and the work of the teacher will become the creativity of man in man, the development in school children of their special and general capabilities.

Restructuring of the school can also proceed along different lines. Along with the single-age collective or class there will be collectives of various ages and for various subjects. Methods of punishment (grades and so forth) will gradually die out, and methods of encouragement will increasingly come to the fore since these develop the personality much more strongly.

As a result, the old foundations on which the school is based will go into the past and the nature of school training will be brought into line with the principally new requirements which are set for the school by the scientific and technical revolution and communist construction.

#### Service of the Family

Such are the main units of this systematic strategy to assist the family and restructure rearing which will obviously help to bring the family and child rearing out of the present web of contradictions and thus improve all development of man as the main bearer of social relations and the main unit of productive forces.

The introduction of this strategy into life will apparently give rise to an entirely new social organism--the all-embracing, universal service of the family: and it will put systematic assistance to the family into practice. The consultative-educational and medical-genetic service of the family and friends which is now being created is the first stage of this comprehensive service. Later new branches of it will probably appear--they will organize household-domestic, housing-social, financial-demographic, child rearing and cultural assistance for the family.

This new social organism will also apparently become a social regulator of the spontaneous development of the family: It will help the pluses of this development and reduce the minuses--that is, create a favorable social environment for family life. Of course, all work of the family service should be conducted delicately, on humanitarian bases and without any intervention in people's private lives.

The path to this goal should apparently begin with experiments, with the search for those units in which state, social, group and private efforts can be most strongly interwoven. It goes without saying that in order for these experiments to succeed we need a permanent working alliance of scientists and practitioners from many specialties, an alliance of state and social organizations, and also scientific discussions and consideration of all steps along this path.

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## SOVIET-FINNISH SEMINAR DISCUSSES MANAGERIAL TRAINING

Novosibirsk EKO: EKONOMIKA I ORGANIZATSIIA PROMYSHLENNOGO PROIZVODSTVA in Russian No 10, Oct 82 (signed to press 26 August 1982) pp 177-181

Article by A. O. Monfor and A. A. Seytov, All-Union Scientific Research Institute of System Research of the State Committee for Science and Technology and the USSR Academy of Sciences (Moscow): "Soviet-Finnish Seminar on Training Management Personnel"<sup>7</sup>

Text<sup>7</sup> Finland was the first capitalist state with which the Soviet Union concluded an intergovernmental agreement concerning scientific and technical cooperation. Since 1955 Soviet-Finnish relations have embraced all the main areas of scientific research and experimental design work, including industry, agriculture, construction, public health, environmental protection and so forth.

The practical work for scientific and technical cooperation between the two countries is carried out within the framework of 32 working groups, of which (on the Soviet side) 9 work in the USSR Academy of Sciences and 23 in other departments. The working group for scientific and technical cooperation in the area of administrative problems was created in 1979.

A significant event in the scientific contacts between the two countries was the symposium and the exhibit which was presented at the same time, "Modern Methods and Means of Training Personnel for the Administrative Sphere" (Tallinn, 7-11 September 1981). Problems of improving the professional skills of managers of modern enterprises are equally crucial for the USSR and for Finland. The rapidly changing environment and the complexity of economic, social and psychological problems that arise place more and more new requirements on the business qualities of administrators. Finland has arranged well the methodological and organizational side of the process of training while the Soviet system is distinguished by more profound scientific development of the aspects of administration related to content. The program of the symposium was arranged in keeping with mutual interests.

The program for training both management and engineering and technical personnel in Finland is constructed taking into account the economic and scientific-technical tasks facing the country. In his report, "The Economic Strategy of Finland and the Role of Administration," the rector of the Helsinki school of economics, professor Ya. Khonko said that the students are

given a detailed explanation of factors that impede Finland's economic development (the relatively high cost of raw material and labor force, the need for large capital investment and the need for increased numbers of scientific personnel. Additionally, Finland is adequately supplied with many mineral resources and has good economic relations with many countries of the world and especially the USSR, and it has a fairly large volume of knowledge and experience in the area of organization and administration of production. Based on this, the main points of the most advantageous economic strategy for the country were formulated:

the discovery of "blank spots" (that is, areas that are not filled) in the world economy and filling them on the basis of rapid organization of the necessary production;

orientation toward external markets with constant analysis of the international situation;

reliance on quality and innovation of products that are produced;

flexibility and active adaptability;

concentration of efforts in the chosen areas;

orientation toward international cooperation.

A paper entitled "The Soviet Strategy for the Development of Administration in the 1980's and the Training of Management Personnel," was presented by the deputy director of the All-Union Scientific Research Institute of Systems Research of the State Committee for Science and Technology and the USSR Academy of Sciences, professor B. V. Mil'ner. Having described the main tasks of the sphere of administration, he singled out three key areas for its improvement: the utilization of modern scientific methods, economic stimuli and levers, and improvement of the organizational structure and methods of administration.

The existing system of training management personnel, said professor Mil'ner, includes basic training of managers of the higher level within the framework of the Academy of the National Economy, teaching the fundamentals of administration in VUZ's and a system for increasing the qualifications of managers in the various branches. The capacity of the system for increasing the skills of managers and specialists is about 2 million people annually, of which about 100,000 are management personnel.

An analysis of the training and education of personnel in the sphere of administration which was conducted by the co-chairmen of working groups made it possible for participants in the symposium to gain a more detailed knowledge of the arrangement of this activity in the USSR and Finland. P. Kaynulaynen, director of the LIFIM, in his report considered the main areas of the work of this institute which is the largest in Finland for training management personnel for industry. The institute was founded in 1958 as the head institution where managers could study methods of administration of commercial enterprises. The firm or institution which sends the specialist for training pays for it. The

LIFIM maintains contact with industry and plans its scientific research work. The students live and study in the training center which is 50 kilometers from Helsinki.

The LIFIM provides training under two programs. The first is intended for managers of subdivisions of industrial companies or people who intend to hold a management position. The course lasts 8 weeks and the average age of the students is about 40 years. Higher education is not a mandatory condition for admission for training. In addition to Finish, it is necessary to know Swedish and English. Two groups of 24 people each study at the same time. The weekly program is calculated for 35 hours of classes and the entire course includes 300 hours. The course is broken down into 3 cycles: 2 with 3 weeks and 1 with 2 weeks. All this takes 10 months.

The training comes as close to practice as possible. The training methods are active and communication among the students occupies an important place. The course consists of 6 subjects: the interrelations between organizations and the external environment; strategic administration; administration of international operations; administration of human resources; decision making at enterprises; and the functions of the enterprise and their unity. The first 3 week cycle familiarizes the students with the functions of the manager under the conditions of Finland, the administrative strategy, and the organizational structure and methods of adapting management to the changes that are taking place. The second cycle considers in detail the functions of administrative and methods of coordinating them. The last cycle reinforces the knowledge that has been obtained and discusses the moral and ethical problems of management. Staff teachers of the institute, directors of industrial companies and specialists from various areas participate in the teaching. Analysis of specific situations and business games are utilized extensively.

The second program is intended for improving the skills of managers who occupy responsible positions in industrial firms. Its purpose is to deepen and update the knowledge of the managers, taking into account the changing economic situation. The program consists of two week-long cycles. In the training they utilize examples from the activity of enterprises, brief reports, conversations in small groups and general discussions.

Each year the institute organizes a so-called "day of lectures" for all the students who have previously undergone training in the LIFIM. Its goal is to familiarize managers with the latest events in the area of economics in the country and abroad and with new achievements in the theory and practice of administration.

The well-known similarity in the organization of training personnel in the USSR and Finland became even more clear in the information about the activity of the Interbranch Institute for Improving Skills of Management Workers and Specialists of the Estonian SSR National Economy, which was given by its director, G. V. Ozerov. The program for managers of the higher level here is intended to last 8 weeks, the middle level--6 weeks, and for specialists--4 weeks. The training methods include active training, temporary duty at enterprises, the utilization of technical means, exchange of opinions among students, general discussions

and course work. The subject matter of the courses includes administration of the national economy, production planning, economic analysis of business activity, organization of the introduction of new technical equipment, environmental protection, labor organization, work with personnel and so forth. The classes are conducted both by staff teachers and by specialists of branches of industry, and managers of enterprises and party and soviet organizations. Scientific and consultative activity are carried out in parallel with the training work.

M. Lakhdenpyaye's course at the LIFIM is devoted to the subject "Analysis of the Enterprise." Within the framework of this course they study questions of the evolution of management in Finland, from the classical functional management to strategic management, and the new conditions and requirements on managers that ensue from this. The entire course is arranged on previously prepared examples. Since it is still new for the LIFIM its leader, M. Lakhdenpyaye, is interested in accumulating more material. This purpose is served, in particular, by research on enterprises which the students of the course defend as their final project.

More and more attention is being devoted to the assimilation of new markets, the acceleration of scientific and technical progress, interrelations with the state policy, the shortage of raw material, problems of utilizing natural resources, and environmental protection. Thus the traditional tasks of providing for the functioning of the enterprise becomes secondary and the most important ones are the problems of the strategy of the firm's behavior. This is reflected in the structure of the firm's administrative agencies: completely new subdivisions appear which are responsible for the development of a long-term policy and for implementing this policy through the traditional functional services of the firm--organization of production, sales, control and work with personnel. The success of the firm's operation is no longer evaluated according to the results of the functioning of the traditional services, but by the dynamic characteristics: whether it is a new or traditional firm, whether it is on the rise or declining, whether the firm meets the external conditions of its operation, and so forth.

L. Lenti devoted his course to internal problems of the firm's operations. He begins with a consideration of the tendencies in the research of organizations. Relatively recently Finland adopted the viewpoint according to which organization consists of two parts: the rigid part (structure, system, strategy) which is oriented toward fulfilling the program, and the flexible part (style, personnel, skills), which takes human factors into account. It is thought that the rigid part has been studied sufficiently and that it is now a matter of understanding the secrets of mobilizing human factors. They are now increasingly recognizing another position according to which the rigid and flexible factors are not only related, but mutually conditioned. This is why sometimes organizations that are similar in organizational structure differ from one another in terms of all the most important parameters. This approach leads to an essential change in the methods of organizational analysis.

The Soviet experience was reflected not only in the speeches of a number of leading specialists (Ya. Leymann, M. Bermant, Yu. Vooglayd and others), but also in the selected presentation of the experience in analyzing the activity

of the enterprise using the example of the Salvo plant, whose methods were developed by the Interbranch Institute for Improving the Skills of Management Personnel of the Estonian SSR.

The exhibit of Finnish equipment "Finman-81" on the subject "Modern Means and Methods of Training Personnel in the Sphere of Administration," which was presented simultaneously and on the premises of the same institute, contributed to the undoubted success of the symposium.

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## IS A HARD-LINE SUPERVISOR IDEAL OR AN ANACHRONISM?

Novosibirsk EKO: EKONOMIKA I ORGANIZATSIIA PROMYSHLENNOGO PROIZVODSTVA in Russian No 10, Oct 82 (signed to press 26 August 1982) pp 182-192

Article by I. V. Lipsits, candidate of economic sciences (Moscow): "A Strict Manager--An Ideal or a Remnant of the Past?"

Text In all of the material published in this column we have tried to make sure that our advice was not too didactic or categorical. As we know, advice is good when it does not contradict our own ideas too much.

"Are you capable of becoming a manager?"--we asked the more purposeful of our readers (1974, No 4), and those who had already reached this goal, we warned about the danger of power in "the seven main sins of the chief" (1975, No 3). Having avoided sin, we extended our hand to help and suggested "How to be a Good Chief" (1975, No 4).

We came out with the appeal, "Director, Know Yourself" (1977, No 4) and avoid the spreading of the disease of the manager--"A Complex of Threatened Authority" (1978, No 1). Those who were not frightened by our advice and overcame all obstacles received the right to a "Career and a Happy Family Life" (1979, No 3).

And you should not be afraid that we are devoting too much time to the shortcomings of the manager--no more will come of that. We shall figure out at the same time exactly what a shortcoming is--this is when something is inadequate, there is not enough of it. If there is not enough of something good, this is bad, and if there is not enough of something bad, this is good. Therefore we shall consider in the heat of the moment that which initially seemed to be a shortcoming to us, for example, the strict style of management. Let us consider this phenomenon from another point of view.

What, more about strict managers? Everything about them should really be clear--during the past two decades the active propaganda of democratic methods of administration should have made this type of manager completely disappear!

This is not at all the case because the concept "strict manager" frequently includes the most varied meaning. If one understands this to mean a dogmatic autocrat who listens to nobody and keeps his subordinates "on a short leash," then this is all correct: his style of administration is now considered to be ineffective and such chiefs are gradually becoming fewer and fewer in number. But if we consider a strict manager who has a previously developed clear-cut plan of action and is able, in spite of any obstacles, to implement this plan, the question of the future of a strict style of management can be placed on a completely different plane.

And again certain readers reply to me: But should such an approach to job obligations be found in any good manager? Alas, we encounter with increasing frequency managers who suffer from "administrative cowardice." They are inclined to give in to circumstances too easily and put up with them, while sacrificing their own principles, especially if the observance of these principles could damage their popularity in the eyes of their subordinates or the higher authorities.

But what features are inherent in a strict manager? In our opinion, there are nine of these basic features.

He is strict, but not cruel. He has firm direction toward the implementation of a task that has been set, but still he certainly does not ignore the feelings of those around him and does not strive to suppress in himself feelings of pity, sympathy or even compassion. Briefly, while striving for a goal, he does not intend to "walk over corpses."

He is uncompromising, but fair. Although a manager frequently has to ignore some people's opinions and interests and make irreversible decisions, a good manager never forgets about his duty to be fair to his subordinates. Firmness softened by a desire to be fair--this is precisely the style which, as numerous sociological questionnaires show, elicits the most respect among the rank-and-file workers. While a strict manager is frequently inclined to single out favorites among his subordinates, those who help him suppress the dissatisfaction of the rest, a strict, but fair manager avoids surrounding himself with favorites, striving to give everyone his just due.

He is decisive, but flexible. A firm directedness toward the achievement of an earmarked result does not mean that the strict manager strives for it with a directness worthy of a rhinoceros. No, he recognizes the possibility and expediency of alternative paths to the goal and therefore he attentively analyzes any new information about the continuously changing situation. Moreover he never regards the gathering of information as a convenient pretext for avoiding making a decision.

He is purposive, but not overly self-confident. Indecisiveness is alien to a strict manager. All of his intentions are directed only toward solving the problem that is facing him, and everything else is perceived as a waste of time. Sometimes he thinks that he knows everything about his business. This kind of excessive self-confidence is dangerous and, as a rule, unjustified--frequently the rank-and-file worker and especially the new worker can notice those aspects of the problem which have disappeared from the purview of the chief.

He is an innovator but a mercantilist. The most appropriate model for the activity of a strict manager is "not everything that is real is reasonable and, unfortunately, not everything that is reasonable is real." The observance of this motto helps the manager a great deal since he is constantly encountering two kinds of subordinates: some say that it is possible to achieve the earmarked goal only if everything is changed, and others assure him that, on the contrary, there is no need to change anything--everything is organized and arranged in the best way and with time the task will fulfill itself.

Under these conditions the manager has to solve a dual problem. On the one hand, to introduce everything that is useful and new to the extent of his forces and resources, and on the other--to limit the scale of introduction of innovations, in order to maintain stable working conditions for his subordinates, since the assimilation of an innovation always requires time and there might not be enough of it to carry out the main task.

He is an optimist, but at the same time a realist. It is hardly necessary to prove that rank-and-file workers can work successfully only when they believe in the possibility of achieving the goals that have been set for them. It is precisely the manager who should instill this optimism in them. Even the strict manager will not be able to achieve success if he influences his subordinates through administrative levers and is unable to motivate them by the process of carrying out the task itself.

But optimism provides an advantage if it relies on a realistic evaluation of all of the manager's information, when he, incidentally, does not consider it superfluous to share this information with his subordinates. Groundless optimism only weakens the collective and, in the final analysis, threatens to undermine the authority of the manager.

He is observant, but discriminating. The manager cannot allow himself to fail to see beyond his own nose; he must always be able to see the situation clearly. To do this he must always have a mass of information going through his mind. But even speed reading sometimes does not help to assimilate it all. The question of how to cope with whirlwinds of information is fairly complex and requires special consideration. Suffice it to say that French specialists in administration have developed special methods for reducing the volume of information a manager must assimilate, having created a so-called control panel which plays the role of a kind of information sieve.

He is powerful but not oppressive. It is easy to be a giant when you are surrounded by dwarfs. To be a leader in a collective of skilled co-workers is much more difficult. But it is only with these subordinates that one can solve any complex problem and not be afraid that they will let you down as soon as you weaken for a moment. Therefore an intelligent strict manager never wants to surround himself with pawns who are good only when they can be moved easily from one square to another. He constantly understand that he must instill in his subordinates an awareness of their own importance and value. Therefore he does not conceal his interest in the words of his subordinates, encourages their practical suggestions and delegates responsibility to them for carrying out individual independent tasks.

He is energetic, but not fanatical. Even for the most energetic manager the supplies of nervous and physical energy are not limitless. Therefore a strict manager must just as strictly stay in good health, periodically planning breaks to "charge up the battery." Moreover, one cannot count on restoring energy once a year during vacation. It is best to devote at least one day a month to healing the wounds of daily stress.

Such, in general outline, is the portrait of the ideal strict manager who is so necessary under the conditions of modern production. But the ideal is an ideal which is encountered extremely rarely in real life and is useful primarily in that it provides reference points for self-improvement.

The first step along this path is a sober evaluation of the peculiarities of one's style of management and one's character. In order to help you in such a self-evaluation, American administrative specialists have developed a simple, but useful test. It is based on the notion that every manager has two kinds of psychic resources: D-resources and V-resources. We expend D-resources (from the word "to act") in order to influence those around us, telling them our wishes, our feelings, our view of problems, and our desire to resolve them as rapidly as possible. V-resources (from the word "to perceive") serve to clarify the feelings, wishes and desires of subordinates and other people whom we encounter in business. The test itself, which the authors used on several thousands of managers of various types of organizations, is fairly large. We shall give only a small fragment.

Read the pairs of statements presented below and evaluate their fairness for you personally. The more you relate to one of the statements of each pair, the higher the evaluation you must give it, but the sum of the evaluations for each of the pairs should be equal to 10 (for example, D-statement--7 points, V-statement--3 points). In order to compare your evaluations with the results of the testing of other managers, multiply the sum of D-points and V-points by three. The average amounts of the evaluations obtained this way were drawn up for a group of 1,200 American managers: for D-statements--54 and for V-statements --66. If your evaluations of each of the kinds of statements are higher than the average evaluations, this can be taken as evidence of your great inclination either to a strict style of management (if the sum of D-statements is greater) or increased sensitivity to influences from outside (if the sum of V-statements is higher).

It should be added that when the American researchers singled out from the overall group those managers whom the higher authorities recognized as promising, it turned out that they typically had a higher than average sum of evaluations for D-statements--about 60 points. This is already a reliable statistical confirmation that the strict style of management produces better results than a desire to gain everyone's approval.

Let us say that we have decided to develop in ourselves the ability to influence others more, and especially our subordinates. Are there any recommendations as to how this can be done? Yes. It is expedient to concentrate your efforts on solving the following problems:

D-statementsV-statements

1. When working with people, I do most of the talking.

Points \_\_\_\_\_

When working with people I spend most of the time listening.

Points \_\_\_\_\_

2. I achieve results mainly by expending my own energy.

Points \_\_\_\_\_

I achieve results by utilizing the energy of others appropriately.

Points \_\_\_\_\_

3. I protect myself from attacks or criticism by responding immediately and decisively. I use my energy to proceed directly to the goal.

Points \_\_\_\_\_

I protect myself from attacks or criticism by diverting or dissipating the energy of my opponents, allowing them to expend their energy on criticism until they are tired.

Points \_\_\_\_\_

4. I always try to make sure that other people understand my point of view.

Points \_\_\_\_\_

I always try to make sure that I understand the point of view of others.

Points \_\_\_\_\_

Total D-points \_\_\_\_\_

Total V-points \_\_\_\_\_

Learn to present information briefly and clearly. It is difficult to count on succeeding in influencing your subordinates and changing the situation in your favor if you have become accustomed to speaking in a "round about" way and you are not able to tell your subordinates extremely clearly what they are to do. Therefore, try to concentrate on making sure that everything you say is pertinent and is presented briefly and clearly. In order to illustrate this point one can consider two examples in the statement of one and the same idea.

"At our conference the main thing is to make it possible for everyone to present his ideas. I, like the rest of the management of our organization, value your suggestions very highly. I know that it was difficult for you to find time to participate in this session and that you are very busy. I know that the rank-and-file workers and management are impatiently awaiting your joint decision and I hope that you will take the most serious attitude to the problem facing you" (unclear and pompous).

"Time does not allow us to waste your energy on several conferences. We need your concrete proposals regarding this issue" (brief and clear).

Learn to identify extremely simply your goals and wishes in those situations in which you find yourself. The main thing is to let the other person know what you personally want and to do this briefly and clearly. Again, in terms of clarity, we shall consider two possible ways of putting one and the same idea.

"And I am confident that you are fully aware of the fact that the adoption of good decisions demands of us all of our energy and knowledge. In this connection I should like to emphasize that I value your ideas highly" (this statement expresses neither the wishes of the speaker nor his desire for the interlocuter to engage actively in solving the problems that have arisen).

"Your participation in the conference is very significant and therefore I request that you make sure to come at the very beginning" (this statement is extremely clear).

Develop in yourself the habit of always clearly presenting those advantages that will come from implementing the decision you have suggested. Let us demonstrate this with an example. "I would like for you to devote more time to consultation with your subordinates."

"I am confident that if you were to devote more time to consultation with your subordinates they would clarify their tasks better and your subdivision would begin to operate even better."

The second statement is more convincing and has a greater force of influence since it emphasizes those advantages which your suggestion promises to the person with whom you are speaking.

Do not be afraid to state the negative consequences which are involved when subordinates fail to follow the course you have chosen. There has never been a manager who has succeeded in controlling a collective only with "goodies"--praise and bonuses. And although it is not necessary to "crack the whip" over the heads of your subordinates all the time, it is sometimes very useful to show them the end of the whip in a difficult situation or in the event that the assignment entrusted to them has failed. One can deliver a tirade like this: "We have already spoken to you several times about the need to improve the work of your division, but today I would like to tell you directly that until you achieve some real improvement you cannot count on any increase or increment to your wages" or "If you do not succeed in making a change in the operation of your department in the near future I will be forced to transfer you to a less responsible position," which is not very pleasant but no one ever said that the work of a manager is easy . . .

And so let us say that you have managed to inculcate in yourself the majority of the aforementioned features and habits and you have come as close as possible to the ideal of a strict, but effective manager. Does this mean that they will now accept you with open arms in any organization or that they will immediately begin to value you more highly? Certainly not necessarily.

Unfortunately, during past decades many organizations have given preference to conformist managers whose main worth consists in that they never contest the opinion of higher management and meticulously play the role of "drive belts" and nothing more. The success of those who like to say yes is quite understandable--it is usually painful for a manager of any rank to hear doubts about the correctness of his instructions on the part of subordinates or their independent decisions which do not correspond to his line (especially if this independence brings success). The degree of intolerance is justified

independence of a strict manager on the part of his authorities is an excellent indicator of how close the authorities are to the "level of incompetence" that was discussed by Hall and Peter.\*

If this is the case is it generally worthwhile to become a strict manager? Perhaps it is best to conform and thus gain the love of subordinates and the favor of authorities? Yes, this will give you temporary success but it will not guarantee you a reliable position, and your well-being will disintegrate the first time you encounter a truly complicated problem, of which there have been more and more in industry in recent years. But if you deliberately inculcate in yourself the ability to achieve the earmarked goal firmly, without compromising for the sake of compromising, demonstrating your correctness and winning supporters to your side, in a time of real difficulties no one will be able to question your value for the organization and your efforts will be repaid 100-fold.

\*Lawrence J. Peter and Raymond Hall, "The Peter Principle," INOSTRANNAYA LITERATURA, 1971, No 8.

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## ELECTRIFICATION PROGRAM OF 1920's AS FIRST GOAL-ORIENTED PROGRAM APPROACH

Novosibirsk EKO: EKONOMIKA I ORGANIZATSIYA PROMYSHLENNOGO PROIZVODSTVA in Russian No 10, Oct 82 (signed to press 26 August 1982) pp 193-205

Article by A. P. Dubnov, candidate of economic sciences, Institute of Economics and Organization of Industrial Production of the Siberian Branch of the USSR Academy of Sciences (Novosibirsk): "Wisdom Turned Toward the Future"<sup>7</sup>

Text<sup>7</sup> Wisdom is the ability to foresee remote consequences of actions, the readiness to sacrifice immediate advantage for the sake of greater benefits in the future and the ability to control that which can be controlled . . . in this way wisdom is turned to the future.

L..Akoff

A special-purpose program approach helps to direct current administration to solving problems of long-term development of public production and provide for an effective transition from the present to the future.

What are the main problems in its implementation? There are only two main problems and they are closely interrelated: expansion of the horizons of planning beyond the limits of the five-year plan and a frontal changeover to intensive development of the economy. In this connection the vice-president of the USSR Academy of Sciences, academician P. N. Fedoseyev noted: "The difficulties of a strategic changeover to the intensive path of development consists in that current needs give way to future undertakings . . . of course the simplest thing to do is to put off planning and the beginning of a radical changeover in planning from one year to the next, from the current five-year plan to the next one under the pretext that all proportions and resources are already 'tied up.' But this only postpones and complicates the urgent problems."<sup>1</sup>

The first experiment in world history involving a special-purpose program approach to the development of the national economy was the GOELRO State Commission for the Electrification of Russia<sup>1</sup> plan. Its authors were clearly aware of the strategic nature of the ties between the present and the future, although the specific problems facing the country at that time were more than enough. Defining the goal of economic activity as "the achievement of the greatest results with the least effort, that is, maximum productivity," they

asserted that in the process of its implementation one should not overestimate the immense population of the RSFSR. The center of gravity in planning work should be transferred "in the direction of skillful anticipation of the future," intensification, mechanization and efficiency of human labor in branches of the national economy on the basis of all-around electrification.

It would not be easy to present the historically concrete essence of these first attempts at a special-purpose program approach more precisely or with more content than was done in the introduction to the GOELRO plan which was written by G. M. Krzhizhanovskiy: "Clearly aware of the difficulties of past times, we have tried to approach the solution to our economic problems from the standpoint of the most rapid elimination of those crises whose continuous effect has conditioned the economic collapse we have experienced. The crises of fuel, food, transportation, raw material, production equipment and labor force are closely and directly interrelated and the solution to the problem can be found in measures whose results will exert the broadest possible positive influence and cover the main factors in all of these crises."<sup>2</sup> After the adoption of the GOELRO plsn by the 8th All-Russian Congress of Soviets, on the suggestion of V. I. Lenin, a state institution was created for further concretization and implementation--the republic Gosplan. G. M. Krzhizhanovskiy became the first chairman of the Gosplan.

In recent years we have begun a new stage in the formation of the program approach in national economic planning. We have determined the role and significance of the Comprehensive Program for the Scientific and Technical Progress of the USSR for 20 Years and the Main Directions for the Economic and Social Development of the USSR During 1981-1985 and the Period Up To 1990. We have set the task of developing special-purpose comprehensive programs as the most important part of the plan. We have indicated the need to draw up programs for the development of individual regions and territorial production complexes, scientific and technical programs in the branches and so forth. We have singled out immediate special-purpose comprehensive programs for the most important socio-economic problems: food, the development of the production of consumer goods and services, the reduction of manual labor, the advancement of machine building, power engineering and all kinds of transportation, chemization of the national economy and so forth. Methodological provisions have been approved for the development of special-purpose comprehensive national economic and scientific-technical programs.

The central publishing houses have published a number of books on special-purpose program planning and administration, which generalize current research in this area:

1. "Problemy programmno-tselevogo planirovaniya i upravleniya" [Problems of Special-Purpose Program Planning and Administration], ed. by G. S. Pospelov, Moscow, "Nauka", 1981.
2. "Programmno-tselevoye upravleniye sotsialisticheskim proizvodstvom. Voprosy teorii i praktiki" [Special-Purpose Program Administration of Socialist Production. Questions of Theory and Practice], ed. by A. G. Aganbegyan, B. Z. Mil'ner and G. Kh. Popov, Moscow, "Ekonomika", 1980.

3. Mil'ner, B. Z. "Organizatsiya programmno-tselevogo upravleniya" [Organization of Special-Purpose Program Administration], Moscow, "Nauka", 1980.

4. Popov, G. Kh., Kosov, N. S. "Programmno-tselevoy metod v upravlenii i planirovani" [The Special-Purpose Program Method in Administration and Planning], Moscow, "Ekonomika", 1980.

5. Budavey, V. Yu., "Dolgosrochnyye narodnokhozyaystvennyye programy (teoriya i metodologiya programmnogo podkhoda v planirovani NTP)" [Long-Range National Economic Programs (Theory and Methodology of the Program Approach in Planning Scientific and Technical Progress)], Moscow, "Mysl'", 1980.

6. Makarov, I., Sokolov, V., Abramov, A., "Tselevyye kompleksnyye programmy" [Special-Purpose Comprehensive Programs], Moscow, "Znaniye", 1980.

7. Payestka, Yu. "Opyt intensifikatsii ekonomicheskogo razvitiya pri sotsializme (faktory i vzaimozavisimosti)" [Experiment in Intensification of Economic Development Under Socialism (Factors and Interdependencies)], Moscow, "Nauka", 1980.

Without claiming to give a detailed analysis of each book, let us consider several aspects of the special-purpose program approach which all of these publications have in common.

#### From the History of the Special-Purpose Program Approach

The authors of each of the books consider the question of the connection between the existing system of planning and special-purpose programs. Three viewpoints which augment one another appear here.

According to the first, planning has always taken advantage of the special-purpose program approach. The development of planning is a process of increasing application of special-purpose program methods to new objects, problems and areas of planned management of the socialist society:

the GOELRO plan;

the five-year plans, including the plans for the Ural-Kuznetsk combine, the assimilation of northern waterways and others in the 1930's, military and economic plans for the period of the Great Patriotic War and plans for postwar restoration of the national economy;

space and defense programs of the postwar period;

the program for cultivating the virgin land;

plans and programs of the 9th and 10th five-year plans;

plans and programs for the 11th five-year plan and the future up to 1990;

the comprehensive program for scientific and technical progress in the USSR: the Food Program for the USSR for the period up to 1990.

The modern stage is a natural result of the increasing experience in special-purpose program planning. On the basis of the arguments that have been given, however, it is difficult to come to the conclusion that the development of the process described is strictly linear 14, pp 10-12; 6 p 947. The decree of the CPSU Central Committee and the USSR Council of Ministers of 12 July 1979 discusses the need to raise the content of planning to qualitatively new levels, increasing the role of long-range plans, the special-purpose program method, and so forth.

The other group of researchers assume that only a rapid leap as a result of the accumulation of plans of programs will lead to transforming them into a system, say, within the framework of the USSR Comprehensive Program for Scientific and Technical Progress, and will lead up to the need to form a program cross-section of national economic plans. Among those proposed for implementation in the national economy are scientific-technical, regional and other special-purpose comprehensive programs. They are brought about by the need to intensify all spheres of the national economy, to accelerate scientific and technical progress, and to increase the scope and complexity of problems and ties in public production. Among the basic arguments for this position is the experience acquired in past decades of setting goals and organizing their achievement in large-scale operations on the basis of modern means of economic and mathematical methods and computer system analysis 1, p 42; 5, pp 7-12.

Finally, proponents of a third viewpoint proceed from the practice of economic construction which shows the great possibilities of a planned economy with the utilization of special-purpose program methods and forms of administration. "The role of intensive factors in the development of the national economy is constantly increasing and special-purpose program methods are becoming an important means of surmounting departmental separation and effectively combining efforts for solving key problems. Their main purpose is the implementation of integrated processes in planning and administration of the national economy. These methods are called upon to provide for overcoming the objective inconsistencies between specialization of functions and their interaction, between division of labor and cooperation of labor, between administrative separation of agencies and coordination of their activities" 2, pp 5, 6.

In keeping with this position they suggest developing special organizational systems of administration of large-scale programs in the national economy with single responsibility for the fulfillment of each program from the beginning to the end. They find out the specific features of the formation of programs during the prewar and postwar periods and the organization of their administration, and consider problems of forming the mechanism for their administration in the modern stage 3, pp 198-204.

The course of events historically led to the generation of the special-purpose program approach in the 1970's. The need for long-range plans and programs for the development of the national economy for 15-20 years made it necessary periodically (with approximately 10-year intervals) to return to the ideas and principles of the GOELRO plan. Let us recall some key events of past decades.

At the end of the first decade of socialist planning with the development and fulfillment of the 1st Five-Year Plan, there was a discussion about issues of constructing a long-range plan. In February, 1930 G. M. Krzhizhanovskiy presented a report at the All-Union Conference of Planning and Statistical Agencies of the USSR entitled, "Questions of Constructing a General Plan." "The changeover to a general plan is . . . a natural next stage," he said. "We are inexorably driven to this stage by the circumstances of our actual economic construction. The scale of this construction is such that we can no longer confine ourselves to its actual dimensions either within the bounds of control figures or within the bounds of five-year plans."<sup>3</sup> It was suggested that work be continued for electrification of the country, solving fuel and transportation problems and economic regionalizing. The general plan was regarded as the "primary means of fighting against bureaucratism in planning."

At the 18th Congress of the All-Union Communist Party (of Bolsheviks) (March, 1939) N. A. Voznesenskiy, having studied the GOELRO plan in depth, advanced the idea of developing a unified plan intended for 15-20 years for the assimilation and introduction of new technical equipment, whose core was to be electrification. And in February, 1941 the Central Committee of the All-Union Communist Party (of Bolsheviks) and the USSR Council of People's Commissars instructed the USSR Gosplan to draw up a general plan for the development of the national economy for 15 years. The Great Patriotic War which began soon after that undermined this idea.

In 1947-1949 large-scale work was done to prepare a general plan for the development of the national economy for 20 years. Participating in it were the USSR Academy of Sciences, branch scientific research institutes, ministries, departments, republic planning commissions and local and soviet agencies. They created 80 subcommissions for developing individual problems of the general plan. The special commission of the USSR Gosplan which was in charge of all the work was headed by N. A. Voznesenskiy. In 1948 a program was earmarked for conducting regional conferences to study the productive forces of the economic regions of the country--the Northwest, the Central Chernozem Belt, the Kuznets Basin, Eastern Siberia, Kazakhstan and the Far East.

The 22d CPSU Congress in 1962 adopted the Program of the Communist Party of the Soviet Union, which included the 20 year future for the development of the socialist society.

The 24th CPSU Congress (1971) set the task of preparing a comprehensive program for further development of technical equipment and technology and, taking this into account, determining all sections and main indicators of the national economic plan.

### The Content of Goals--the Parameters of the Future

The goal as a category and the content of a desirable future of objects and systems controlled by people is an extremely insidious object. For the goal is above all the product of human consciousness and as such it is immaterial. The history of human thought shows the immense and contradictory experience of utilizing the goal and productive concepts (expediency, position of goal, means to achieve the goal, and so forth). They try to use the goal to explain the development of nature and society and excluded it from science. They used the goal to prove that God exists and that He does not exist, that people's goals are eternal and that goals change, that there is a special class of goal factors which control human activity and that people's behavior is determined only by external influences . . .

The books we have considered have an abundance of ideas about the constructive role of goals in the development of programs and plans, the significance of prognostication as an instrument for obtaining knowledge about the future, mathematical modeling, variants of prognosticatory and planning calculations, the need for hierarchical system analysis and decomposition of goals, and so forth. Let us take the first of our list of books, which might have the most complete grasp of special-purpose program problematics in the context of national economic planning from the standpoint of the mathematical theory of decision making (investigation of operations) and system analysis. It contains an excellent introduction to the history and theory of research on operations and the system approach, principles and the schema for special-purpose program planning of the national economy, models of the development of the complex of branches, the dialogical process of planning, methods of constructing a system of models of dialogical planning, the formation of coordinated programs for the development of capacities and the output of products in the branches, mathematical aspects of analysis and the implementation of the dialogical process of planning.

But the approach to the categories of the goal in it, in our opinion, is fairly linear. As a result of this the dialogical process of planning looks more like a monologue of higher units in the hierarchical system of individuals who are making decisions. And the essence of the matter is not explained consistently by the comparison of the Borodino defeat and the battle at the Kursk salient with the selection of strategies for increasing the energy availability of economic regions [1, p 54].

In the system of goals of the national economy which, unfortunately, does not reflect the territorial cross-section, goals of the first level are singled out from the general goal (well-being and security): defense, public health, culture, education, private consumption, daily life, transportation and information service. In our opinion, strictly speaking, these are not goals, but spheres of activity and life support in which the goals must still be determined qualitatively and quantitatively. In spite of this goals of the second level are introduced. They are not filled with content either. They are rather areas for determining secondary goals (and they are means of achieving goals of the first level), that is, goals of interbranch complexes of material production and the nonproduction sphere--machine building, electronics, instrument

building, construction, chemistry, energy, metallurgy, agro-industry, wood processing, transportation, information and science. It is asserted that the goals of the production sphere are determined by the primary goals of the society and depend on them. Such clarity and simplicity impresses the reader. But he must take into account the efforts which the party and the state exert in order for the ministries and departments to fulfill even their own planned assignments, not to mention the independence and precise correspondence of higher goals of the society and the immediate goals of one industry or another.

Right up until 1979 such logic was a common phenomenon in literature that interprets problems of decomposition of goals on the national level. The simplistic directness and one-sidedness of the reasoning concerning the formation of national goals performed a useful mission in the first stage of scientific development. Now it has given way to more complex classifications of special-purpose programs which are closer to life and are not confined to the simplest two-dimensional outlines. During the process of developing actual programs it became clear that responsible and well-reasoned content in the formulation of national ideas and their decomposition turned out to be a most complex, creative and unformalized procedure. Experience has also shown that it is no less dangerous to consider simplistically the goals of various organizations and programs as relations of one-sided and univalent subordination, since not only do special-purpose programs engender and assimilate the necessary organizations, but organizations too can deform the goals of the program. The readers will find interesting material on these problems in the books 1/2, p 33, 132; 3, c 1, v; 5, c 3, 47.

The special-purpose aspect is the most difficult one in the special-purpose program approach. And is it not a joke to express ideas which are still not generally accepted about the desirable conditions of social subsystems? Today only prophetic enthusiasts are careless in this area. Prognosticians and programmers, after the "prediction boom" of the 1970's and the subsequent reality of the 1980's, have become more circumspect.

#### Society and Special-Purpose Programs

The last in our list of books, by the well-known Polish economist, Yuzef Payestka, is presented to the reader by academician O. T. Bogomolov. This book, in our opinion, is related to the literature about the special-purpose program approach, but not in terms of the system-program attributes and not in terms of its name. It considers a complex of profound problems of the socialist economy that arise when the national economy is changed over to the basis of intensive development.

The author begins the book with a chapter entitled "The Process of Development in the Historical Perspective" and ends with the chapter "Goals and Means in the Process of Development." He immediately states his attitude toward theoretical concepts of economic growth that are based on quantitative analysis. "Although they have their positive features, contributing to the development of quantitative analysis, at the same time they limit thinking in a number of ways, leaving on a secondary level certain issues of a fundamental nature which are not subject to simple analysis of the interdependencies of development.

Therefore in a general theoretical approach I have tried to use those methods of analysis and presentation which would not have any such limitations"  
[7, p 137].

He is speaking about the human factor and social interconnections in development, and about the dynamism of innovations. Thus one of the chapters is entitled, "Social Justice--The Social Goal and the Factor of Progress." We are aware of how inconvenient it is for specialists in quantitative analysis to deal with such a factor in progress as social justice--it cannot be measured or calculated and in general it is unformulated. Yuzef Payestka has an excellent understanding of this. But if, to use his words, in a society equalizing tendencies appear and become stronger, impeding the satisfaction of the main requirement of social justice--the principle of equal opportunities--and also other requirements, then it is difficult to expect of people the dynamism of innovations--the motive force of progress. In this situation special-purpose programs and system instruments will not help, for man is the main bearer of progress. If one who does not need changes does not want progress either, the dynamism of innovations is even more alien to him--in science and technology, social institutions and public relations. Here we are obviously dealing with those forces of a socialist society which are the only ones which can advance the cause of implementing national economic special-purpose programs. Such is the significance of the human factor in development according to Yuzef Payestka.<sup>4</sup>

Presenting the reader with extensive material content for reflecting on the interconnection of goals and means in the development of a socialist society, Yuzef Payestka considers the concept of understanding human needs. One can, for example, reduce these needs to the amount of products and services that are consumed. "The realization of this concept can lead to a situation where social activity, in the first place, will not correspond to the actual needs, desires and wishes of people, and, in the second place, will distort them and give people inappropriate models . . . it seems that in the concept of understanding human needs as a whole, in addition to increased consumption and improved working conditions, it is necessary, above all, to take into account the need for humanization of labor, improving man's qualitative properties and his need for real participation in socio-economic life and the realization of socialist social justice" [7, pp 260-261].

#### Popularization--Not a Simple Matter

To the extent that special literature regarding the special-purpose program approach strives for scientific precision and the corresponding manner of presentation it is removed from the mass reader. It is not always possible to combine scientific exactness and accessibility. But if wisdom is the mission to foresee the remote consequences of actions, which is the responsibility of people who make decisions, the readiness to sacrifice immediate advantage for the sake of larger benefits in the future is the domain of the broad masses, who must be convinced of this.

Our country has positive experience in informing the general reader about the most complicated and crucial problems of the economy. One of the outstanding examples and models is the text of the GOELRO plan. Books that have been published recently also contain attempts to discuss special-purpose program

problems with the general reader. In our list the publication listed as No 6 does this. It can become a valuable support for an introduction to the special-purpose program approach, but now, in our opinion, it is being impeded by the methods of popularization that have been selected.

In spite of the immense number of approaches, methods and procedures, it is very difficult to formulate the main goal of the socio-economic program for the distant future. The next operation--placing the goals in the system of subgoals and tasks of various levels (reduction and decomposition, breaking down and subdividing the main goals)--is also an important and responsible aspect. A large number of publications are devoted to this problem, and they can rarely do without describing the PATTERN system. Authors refer to it [6], but they devote more attention (like many others) to the relatively simple part of the methods--norm setting procedures for determining the coefficients of the contribution to achieving the main goal, and they devote considerably less attention to the normative nature of the formation of the levels of the tree of goals. Here they completely lose sight of the essence of the methods.

And the essence is this. When the Honeywell firm was preparing the PATTERN system for operation, it conducted a prognosticatory analysis of thousands of technical parameters and functional characteristics of elements of the tree of goals in order to determine the limits of effectiveness of known technologies and to find principally new technologies with greater effectiveness.<sup>5</sup> And only after this did they analyze the strategies for achieving the main goal. The matter, consequently, consists in explaining what existing technical equipment and technology is capable or not capable of producing tomorrow. Qualitatively higher (as compared to the level already reached) effectiveness of production-economic and other systems can be attained on the basis of technological systems with higher effectiveness which do not yet exist. It is necessary to go beyond the limits set by natural and scientific principles which have been materialized in working technical equipment and technology. The unprecedented goals presuppose the creation of unprecedented means of achieving them--an axiom of modern scientific and technical progress which determines the principles of special-purpose programming. And this is not the only reason why it is difficult to apply PATTERN methods using information concerning them which has been published in scientific literature. The authors of this system have concealed too many profound and precise aspects in their publications, leaving for the readers' consideration the attractive, but not the most profound or operationally accessible aspect of the matter. In our day "know-how" is very costly.

The example of decomposition of goals considered in book [6] immediately after the description of the PATTERN methods is outstanding in that it is exemplary and adequate to special-purpose economic programming. Apparently the authors intended for it to be more accessible to our readers. Using theoretical set devices he explains the reduction of the "goals" of a monkey [6, p 67]. Quite seriously, as it were, the actions of the monkey to get bananas that are hanging from the ceiling of the room (to approach them, to move a box, to climb up on it and to grasp them) are formalized with the language of set theory, investigation of operations and decision making. Thus it is left to the educated readers to rise to the level of special-purpose programming by themselves. Nobody apparently noticed the irony in this example during the process of publishing the book.

Nonetheless intending to expand the erudition of the readers concerning goals, the authors give a laconic description of the evolution of the category "goal" in the ideas of the great thinkers and also in the interpretation of the Large Soviet Encyclopedia. Quoting K. Marx (Chapter 5, volume 1 of "Das Kapital") and abridging the quotation to the length of an aphorism, the authors did not exert the effort necessary to understand Marx' idea that a conscious goal "like a law determines the method and nature . . . of actions" [6, p 117]. The law of actions is precise and profound. But whose actions? This is the question! Marks says here that he has left outside the realm of his research on the process of labor as a purposive activity not only monkeys, but other thinking animals. He wrote: "We shall not consider here the first animal-like instinctive forms of labor. The condition of a society when the worker enters the commercial market selling his own labor force and the condition that goes back to the depths of primitive times when human labor was still not relieved of its primitive, instinctual form are separated by an immense interval. We mean labor in the form in which it is exclusively the property of man."<sup>6</sup> In general it is clear that it is hardly appropriate to equate the goal like actions of monkeys and the purposive activity of man even in a didactic, instructive example.

These remarks were not made, however, in order to undermine confidence in the book, but to contribute to further improving it. It would not be inappropriate to improve the graph in the book showing the condition of the scientific problem "Development of Methodology for Forming Special-Purpose Comprehensive Programs," which, "without claiming absolute completeness" reflects the achievements of domestic schools (see p 100). And this can be done on the level of modern scientific methods. Then the genesis of the modern stage in the development of the special-purpose program approach would not arise out of nonexistence in 1968 or rely only on foreign publications. The book by Ye. Yanch, for example, appeared in 1967 and in 1970 it was translated into Russian by the Progress Publishing House. But the special-purpose program approach of our time is the successor of the ideas in the GOELRO plan. It would be difficult not to take this experience into account when developing modern programs for scientific and technical progress. This is why a scientific history of the special-purpose program approach in socialist planning could be so important.<sup>7</sup>

Returning to the transition from the present to the future on the basis of special-purpose programs, it remains to conclude that wisdom, if it is really turned to the future, presupposes a knowledge of history, the ability to set goals filled with content, analysis of social factors and conditions, and persuasion of the broad masses.

#### FOOTNOTES

1. "Science and Crucial Problems in the Development of the National Economy," Section of the general meeting of the USSR Academy of Sciences, 13-14, December, 1979, Moscow, "Nauka," 1980, p 34.
2. GOELRO Plan, Moscow, Gospolitizdat, 1955, p 44.

3. Krzhizhanovskiy, G. M., "Sotsialisticheskoye stroitel'stvo" [Socialist Construction], Moscow--Leningrad, Division for Scientific and Technical Information of the USSR People's Commissariat of Heavy Industry, 1936, p 281.
4. See also Payestka, Yu., "The Human Factor as a Basis of Strategy for Development," paper presented at the 6th Congress of the International Economics Association (Mexico, August 1980)--VESTNIK AKADEMII NAUK SSSR, 1981, No 1.
5. See Yanch, Erich, "Prognozirovaniye nauchno-tekhnicheskogo progressa" [Prognostication of Scientific and Technical Progress] 2d ed., Moscow, "Progress", 1974.
6. Marx, K., Engels, F., "Sochineniya" [Works], 2d ed., Vol 23, p 189.
7. For more detailed information about the development and the beginning of the implementation of the GOELRO plan, see: Protocols of the Presidium of the Gosplan for 1921-1922, Vols 1, 2, Moscow, "Ekonomika", 1979.

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## NEED FOR PHYSICAL EXERCISE, ESPECIALLY AMONG MEN, EMPHASIZED

Novosibirsk EKO: EKONOMIKA I ORGANIZATSIIA PROMYSHLENNOGO PROIZVODSTVA in Russian No 10, Oct 82 (signed to press 26 August 1982) pp 206-216

[Article by M. Ya. Sonin, doctor of economic sciences, professor, Institute of Economics of the USSR Academy of Sciences (Moscow): "Obstacle Course"]

[Text] Like everyone or almost everyone who has begun to restore his health in middle age, I was brought to this point by severe necessity.

When I approached the age that is critical for my family, when my parents died (almost at the same time), my health, burdened by a bad genetic heritage, began to give me trouble. True, even in my student years I tried to look after my health: I drank almost no alcohol and hardly smoked at all. But at the very beginning of my student life I suddenly came down with tuberculosis. The disease was critical, and for several years I was subjected to a pneumothorax--an artificial compression of the lung. Nonetheless after each cold the tubercular process became worse. It seemed that I would never recover.

And then a doctor once recommended that I harden my condition with cold water and strong massages. Every day, regardless of the conditions (I lived in a dormitory) the toughening procedures helped me to avoid the annual worsening of the tubercular process and, finally, to put an end to it altogether. I put an end to the tuberculosis but I began to lead a sedentary life which was promoted by my work in the USSR Gosplan and my bent toward science, which for a long time "glued" me to my desk and chair. Then when I had reached 58 arrhythmia and other heart troubles appeared.

It was precisely at that time that my son gave me the book by Gilmore "Run for Your Life," and I, like hundreds of other Soviet citizens, began to jog. The first time I could not even run 50 meters without stopping. Then things improved and my heart gradually became stronger, but I still did not manage to get rid of my frequent colds.

I added swimming in cold water to running and at the age of 65 I discovered a new way of fighting colds. Now I am fairly active and able bodied in spite of my more than 70 years. At least half of this is because of running.

For almost 12 years now I been head of the runners' club of the Moscow House of Scientists. This club was one of the first in the country. It is perhaps because of this and because of the large amount of propaganda work of our runners' club that I was elected to the presidium of the all-union council of sports veterans and also was awarded the esteemed Emblem of the 50th Anniversary of the GTO along with such veterans as N. Ozerov, L. Yashin, I. Rodnin and other honored masters of sports.

I am writing all this in order to convince you, dear readers, of the correctness of N. M. Amosov who stated: there is practically no point at which one cannot restore their health. But, of course, the later one comes to this decision, the more difficult it is to reach the goal--health, which provides much more satisfaction than immediate joy, for which ones pays precisely with health (overeating, smoking, excessive drinking). We shall return to this.

I shall now discuss the equipment necessary to looking after one's health. This includes floor scales costing 12 rubles and constant attention to the thickness of the layer of fat on one's stomach. We put on a light sports outfit and go to it, without closing our mouths and gradually increasing the distance of the runs.

Remember: the older you are the less weight you should carry, and this is achieved by balance in behavior: eating less, moving more, using less medicine. Of course, roughly speaking, 50 percent of our health depends on genetic factors, but the other 50 percent depends only on our own behavior.

#### On the Weakness of the "Stronger" Sex

Why has the stronger sex become weak? This subject has become very popular recently. And indeed it is very important to explain the causes of the continuously increasing difference between the life spans of men and women. During the past 40 years the amount of time by which women live longer than men in the USSR has increased from 6 to 10 years, and as compared to prerevolutionary Russia (1896-1897) this difference amounted to ten years, having increased five-fold: from 2 to 10 years.

What are the reasons for this ratio?

The main ones, in the opinion of the majority of scientists are: in the first place, the increased sedentary life both in work and in daily life; second, the widespread alcoholism and smoking among the male population; third, the frequently more "risky" working conditions (the possibility of injury and so forth).

Table 1. Average Life Expectancy of USSR Population (years)

Years	Men	Women
1938-1939	44	50
1958-1959	64	71
1979-1980	64	74

Scientific and technical progress and mechanization and automation of production lead to a situation where muscular exertion is regularly decreasing, and not only in the processes of primarily mental labor, but also in the processes of primarily physical labor. And here the expenditures of muscular energy are increasingly being eliminated from the active components of the technological process. There has been a considerable expansion of the group of professions that require hard intellectual activity, profound and extensive knowledge, which are used without physical exertion. Even for a considerable proportion of the men employed in the classification "primarily physical labor" the labor operations are reduced to controlling mechanisms with negligible amounts of muscular exertion.

As we know, living conditions have also changed, and in particular the development of household machines liberate the man from physical work in the home. The forms of men's recreation have also changed: to a considerable degree, they have been transformed from active into passive ones. The favorite pastime is now hockey . . . on television.

But motor activity has been, is and will be a primary physiological need of each individual, which is no less important than eating or sleeping. A limitation or a lack of motor activity has a negative effect on the development of young people, on the normal life activity of adults and to an even greater degree on older men. The number of cardiovascular and other diseases which previously were found among the elderly, and now are increasingly afflicting young people, is increasing.

The most widespread form of cardiovascular disease that is related to a sedentary way of life is arteriosclerosis. It is the cause of more than half of the male deaths. Improvement and further development of the health protection system alone cannot prevent disease and correspondingly reduce the death rate of males. Therefore it is necessary to teach them a healthy way of life.

Men's free time is a socio-economic and at the same time a socio-hygienic problem which requires an immediate solution. According to the expert evaluation of a group of physicians specializing in the area of social hygiene, material and labor expenditures on preventing disease related to inadequate movement are dozens of times less than those on rehabilitation, that is, on restoring the health. And this is quite understandable: the employment of medical personnel for prevention is considerably less than for treatment of patients, and there is no need for medicines, costly stays in special therapeutic institutions and so forth. No less important is the fact that the main active force here is man himself, who is vitally interested in his own health.

Unfortunately, personal health has still not been adequately developed. This is not so much the fault of medicine as of the direction of the physical culture and sports movements. L. I. Brezhnev correctly pointed out at the 26th CPSU Congress that "for the majority of people sports are still only for spectators."

A reduction of hypodynamism by all means and all spheres of life has become a most important element in the formation of a healthy way of life for the male population. Running for health or, as it is still called, jogging, has taken first place among these means in recent years.

But why are there still so many men who avoid physical exercise in all ways, preferring to be constantly ill, causing torment both to themselves and to their loved ones, to be excessively fat and thus produce an unfavorable impression, and to age prematurely, depriving themselves of the joys of life and creative labor? I think this is because these people do not have the courage to take the first decisive and irreversible step in the struggle for themselves. This step requires a considerable amount of will power. Having crossed over the border of a passive and slovenly existence, the man is transformed from a patient swallower of pills, from an object of therapy, into the main acting individual in solving his own life's problems. One must choose: either stimulate yourself and constantly overcome the inertia of the existing stereotype of life and rise to the heights of physical health and spiritual balance, or fall back on the stairway of poor health and disease.

Professor B. Urlanis suggested joint consultation with men (similar to that with women) where the men would learn to lead a healthy way of life, staying away from vodka and tobacco, and avoiding accidents. But with all the interest in the article entitled "Spare the Men!" the questions of consultations was not even considered. The available and free medical assistance has made us lay the concern about our health on the shoulders of the physicians. But it is worthwhile to wait until we need medical assistance?

We know of an immense number of means of physical self-improvement that make it possible to remain healthy and hardy until advanced old age without the help of a physician. We are speaking about natural factors: physical exercise, particularly running, tempering and moderation in eating.

#### A Little Economy

It seems that the well-known expressions "economy is important to everyone" applies fully to the development of the physical culture of our population. Let us see how money from public funds is distributed between the so-called profitable and non-profitable kinds of sports.

Let us take, for example, hockey. This is a very interesting spectator sport, a sport of real men. But a thousand times more people "hurt" over the outcome of a hockey game than participate in it.

But for such kinds of sports as, say, running for health, sports orientation and even tennis, where no one or almost no one hurts, the amounts transferred from the consumption funds are hundreds and thousands of times less than for spectator sports. The chairman of the party control committee, a member of the Politbureau of the CPSU Central Committee, Comrade A. Ya. Pel'she quite correctly noted (KOMMUNIST, 1981, No 11) that the public funds are frequently spent irrationally, on leaders of plant football teams whom nobody needs, who take people away from their immediate work and require a good deal of money.

I should like to add that the large and almost uncontrolled amounts of money from public consumption funds "vanish" for all kinds of "health trains" and passes to sanatoriums and houses of recreation. Why do I doubt these traditional forms of health improvement? About "health trains" they too frequently say that "nothing joins people together" like a joint trip outside the city. Stays in houses of recreation and even in sanatoriums are frequently accompanied by immoderate drinking.

Unfortunately we have still not accounted for the healthy kinds of sports whose significance both for the health and for the economy is difficult to overestimate. It seems quite obvious that in order to develop these kinds of sports it is necessary to develop a system of material and moral incentives. As for moral incentives, generally speaking, they already exist. Mainly in the form of a certain competition for indicators that describe the degree to which the population engages in various kinds of sports work. The management receives bonuses for meeting this indicator. But it seems to be that the most important bonus does not exist--the bonus for health for the person who is not ill. For what do they receive? Passes to sanatoriums and houses of recreation are given primarily to those who are frequently ill. But in fact bonuses should not be given for illness (for the bulletin is a kind of bonus from public funds at the expense of those who are healthy), but those who work without being ill should be encouraged.

It seems that a bonus for "non-illness" which would be allotted from the same public funds could also motivate the managers of enterprises who encourage sports and especially those who themselves are an example in this respect.

It would also be possible to establish certain indicators of the efficiency factor of our sports facilities. Despite the special decisions, these facilities, even in Moscow, remain unused, at least by half.

#### Confronting the Patient

But why are even the most undemanding with respect to time and equipment and highly effective kinds of sports still not widespread? Let us try to answer this question using the example of running for health.

Without going into detail one can say that jogging will become a mass sport if we meet three conditions:

active publicity of running for health on the part of most of the physicians;

active support from the public (transforming running for health into a "fashion");

taking charge of one's self (inertia, indecisiveness, ignorance of the need to engage in running for health, and so forth).

These conditions are interconnected, but the most important, in my opinion, is the first. Many people think that first it is necessary to overcome public opinion. In this connection I am reminded of a case from my practice. Once

I tried to run in shorts and a T-shirt along Lenin Prospekt in the capital. On the way I heard extremely uncomplimentary remarks about the condition of my mental capabilities, and when I decided to drop into a food store for bread I simply caused a panic among the poor clients and was forced to leave without having bought anything.

Unfortunately people frequently abandon running because of the ridicule from those around them. As academician N. M. Amosov correctly states, "publicity of any measures pertaining to health is effective only with the widespread support of physicians" and there are extremely few physicians who deal with running for health. It is quite understandable that physicians who have not experienced the favorable influence of running themselves are not in a position to provide a concrete example or even give recommendations to their patients. It is impossible to introduce running for health everywhere without it being a popular and mass sport, above all among physicians.

There is still not a single medical textbook that has a chapter or even a paragraph that gives a theoretical substantiation for the need and significance of running for health (running itself, and not the role of movement in general), even when justifying the methods of rehabilitating cardiovascular patients, not to mention the conduct of patients under hospital conditions. There are no publications of this kind, or almost none, in the medical journals either. The statements on this subject from medical personnel are very timid in popular medical literature as well, and this intended, incidentally, not for medical personnel, but for their patients.

Even in those countries where running for health is very developed, for example, in the United States, it does not receive the proper support from medicine. The American physician MOU wrote: it is a pity to recognize that running, which has immense merits, is ignored by official medicine. We claim to be interested in preventive medicine and we know that arteriosclerosis is responsible for more than half of the annual death level. Moreover research on animals and men shows that training through running increases the volume of blood that goes through the heart, increases the ability of the cardiovascular system to operate, reduces the frequency of heart contractions during rest, and reduces the content of lipids in the blood. So why is it not clear to many of us physicians how necessary it is for ourselves and our patients to train for endurance?"

There is a serious psychological barrier on the path to the recognition of running by medicine: throughout the world physicians, on a purely empirical basis, have come to revise the conditions for rest and to recognize the need to replace it with early motor activity for many diseases and even for mild cardiac infarctions. As a corresponding member of the Belorussian SSR Academy of Sciences, N. I. Arinchin, says, we previously thought that the skeletal muscles are only the consumers of blood. When they are in operation they require 60-80 times more blood than during rest, which increases the load on the heart. Motor rest serves as a protective condition for the heart. But clinical practice and life have shown that these conditions are destructive to man's heart. Therefore even for patients with infarctions, instead of rest physicians frequently prescribe early movement and physical loads which contribute to accelerated restoration of the health.

Today we know that the skeletal muscles help the heart and that without this assistance it is more difficult for the heart to cope with its work and it becomes exhausted more quickly, and that if the intramuscular micropumps operate actively the blood supply to the skeletal muscles as self-providing organs improves. Hence it is necessary to draw the theoretically and practically substantiated conclusion that the reasons for hypertonia, infarctions and other cardiovascular diseases lie not only in the stress factors, incorrect nutrition and genetic predisposition, but also in inadequate movement. As doctor of biological sciences and honored scientific activist, S. V. Andreyev, correctly notes, a clear understanding of the fact that the skeletal muscles participate actively in the blood circulatory system opens up the path for scientifically substantiated physical training of children, for protection of the health and prevention of cardiovascular diseases. This knowledge must finally be utilized in practical medicine. And, we might add, particularly for the development of running for health. The point about the "peripheral heart" is of immense significance for improving therapeutic physical culture in clinics and also for substantiating conditions for motor activity of patients with various diseases, primarily cardiovascular diseases. It should become a basis for the development of broad and detailed programs for overcoming the harmful consequences of hypodynamism, which is increasingly conquering modern man.\*

But the development of running for health depends, of course, not only on physicians. It seems to me that the direct interest of those who desire or potentially desire to engage in running gives us the right to request (and even insist) that our press, and not only the sports, but also the economic press, allot more space to this form of improving the health of the population, and in particular that they publish the statements of physicians and managers of enterprises and institutions who run. Let us look at experience abroad.

In the United States in recent years the number of workers and employees who are running for their health has been increasing rapidly with encouragement and assistance on the part of employers. Thus the "Center for Strengthening the Heart" (New York) serves 40 firms, offering them special programs for strengthening the heart and reducing the danger of infarction: 85 percent of the participants train at the expense of their enterprises (a total of 1,200 participants).

True, this is not without its amusing aspects: the sports center of the Exxon petroleum company gives all those who go on business trips . . . jump-ropes. The employers expect that as a result of these efforts there will be a smaller number of absences because of illness and labor productivity will increase.

A serious theory of running has not yet been created, and many of the various scientific achievements in the area of creating this are still far from introduction into mass practice. The experience of our club at the Moscow House

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\*"What Harvey Did Not Say," NAUKA I ZHIZN', 1981, No 2

of Scientists with medicine shows that this form produces fruitful results. All members of the running club have repeatedly confirmed that health is an economic category!

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